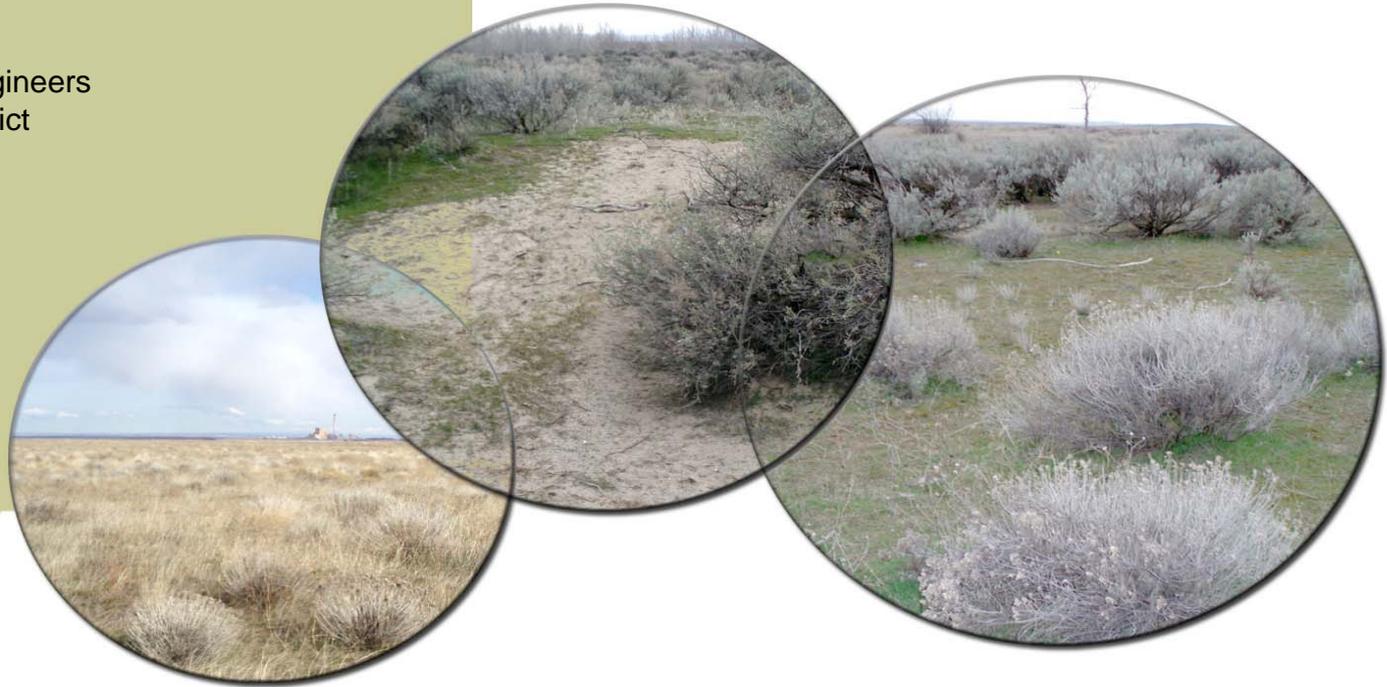




U.S. Army
Corps of Engineers
Omaha District



DRAFT FINAL SITE INSPECTION REPORT

Boardman Air Force Range
Morrow County, OR
FUDS PROPERTY No. F10OR0160

Site Inspections at Multiple Sites, NWO Region
Formerly Used Defense Sites
Military Munitions Response Program

Contract No. W912DY-04-D-0010
Delivery Order No. 003

July 2007



Shaw Environmental, Inc.
9201 E. Dry Creek Rd.
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The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as official department of the Army position, policy, or decision, unless so designated by other documentation.

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July 2007

Submitted to:

U.S. Department of the Army
U.S. Army Corps of Engineers, Omaha District

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List of Acronyms

°F	degrees Fahrenheit
µg/L	micrograms per liter
ADR	Automated Data Review
AFR	Air Force Range
AOC	area of concern
ARC	Annual Report to Congress
ASR	Archives Search Report
BAIC, INC	Boardman Agri-Industrial Complex, Inc
bgs	below ground surface
CCB	continuing calibration blank
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CSM	conceptual site model
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
DERP	Defense Environmental Restoration Program
DMM	discarded military munitions
DoD	Department of Defense
DOI	Department of Interior
DQO	data quality objective
DFW	Department of Fish and Wildlife
EDR	Environmental Data Resources, Inc.
EPA	Environmental Protection Agency
ER	Engineering Regulation
FR	Federal Register
FS	feasibility study
ft	foot or feet
FUDS	Formerly Used Defense Sites
GP	General Purpose
GPL	GPL Laboratories, LLLP
GPS	Global Positioning System
HE	high explosive
HRS	Hazard Ranking System
HTRW	hazardous, toxic, or radioactive wastes
ICB	initial calibration blank
IEP	Important Ecological Place
INPR	Inventory Project Report
lb	pound
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
mm	millimeter
MMRP	Military Munitions Response Program

List of Acronyms (Cont.)

MRA	Munitions Response Area
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
NAD	North American Datum
NCP	National Contingency Plan
NDAI	No Department of Defense Action Indicated
NGVD	National Geodetic Vertical Datum
NWO	Northwest Region (Omaha District Military Munitions Design Center)
ODEQ	Oregon Department of Environmental Quality
OR	Oregon
PA/SI	Preliminary Assessment/Site Inspection
PETN	pentaerythritol tetranitrate
PGE	Portland General Electric
QA/QC	Quality Control/Quality Assurance
RAC	Risk Assessment Code
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROE	rights of entry
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SDG	sample delivery group
SEDD	Stage Electronic Data Deliverables
Shaw	Shaw Environmental, Inc.
SHPO	State Historic Preservation Office
SI	Site Inspection
SLERA	Screening-Level Ecological Risk Assessment
SOP	standard operating procedure
SOW	statement of work
SOAP	Sampling and Quality Assurance Plan (SOAP)
SSWP	Site-Specific Work Plan
TAL	Target Analyte List
TNT	2,4,6-trinitrotoluene
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
USC	United States Code
UTL	upper tolerance limit
UTM	Universal Transverse Mercator
UXO	unexploded ordnance
VSP	Visual Sampling Plan
Weston	Weston Solutions Inc.

Glossary of Terms

Comprehensive Environmental Response, Compensation, and Liability Act of 1980

(CERCLA) – Also known as “Superfund,” this congressionally enacted legislation provides the methodology for the removal of hazardous substances resultant from past / former operations. Response actions must be performed in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (USACE, 2003). CERCLA was codified as 42 USC 9601 et seq., on December 11, 1980, and amended by the Superfund Amendments and Reauthorization Act (SARA) on October 17, 1986.

Defense Sites – Locations that are or were owned by, leased to, or otherwise possessed or used by the Department of Defense (DoD). The term does not include any operational range, operating storage, or manufacturing facility, or facility that is used for or was permitted for the treatment or disposal of military munitions (10 USC 2710(e)(1)).

Discarded Military Munitions (DMM) – Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed consistent with applicable environmental laws and regulations (10 USC 2710(e)(2)).

Explosive Ordnance Disposal (EOD) – The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded ordnance and of other munitions that have become an imposing danger, for example, by damage or deterioration (10 USC 2710(e)(2)).

Formerly Used Defense Site (FUDS) – Real property that was formerly owned by, leased by, possessed by or otherwise under the jurisdiction of the Secretary of Defense or the components, including organizations that predate DoD. Some FUDS properties include areas formerly used as military ranges (10 USC 2710(e)(2)).

Military Munitions – Ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the DoD, the U.S. Coast Guard, the U.S. Department of Energy (DOE), and the National Guard. The term includes confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives, and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunitions, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components of the above.

The term does not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components, other than non-nuclear components of nuclear devices

that are managed under the nuclear weapons program of the DOE after all required sanitization operations under the Atomic Energy Act of 1954 (42 USC 2011 et seq.) have been completed (10 USC 101(e)(4)(A) through (C)).

Munitions Constituents (MC) – Any materials originating from unexploded ordnance (UXO), DMM, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions (10 USC 2710(e)(3)).

Munitions Debris (MD) – Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal (10 USC 2710(e)(2)).

Munitions and Explosives of Concern (MEC) – This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks means: (A) Unexploded ordnance as defined in 10 USC 101(e)(5); (B) Discarded military munitions, as defined in 10 USC 2710(e)(2); or (C) Munitions constituents (e.g., TNT, RDX), as defined in 10 USC 2710(e)(3), present in high enough concentrations to pose an explosive hazard (10 USC 2710(e)(2)).

Munitions Response Site (MRS) – A discrete location within a munitions response area that is known to require a munitions response (32 CFR§179.3).

Munitions Response Site Prioritization Protocol (MRSPP) – The MRSPP was published as a rule on October 5, 2005. This rule implements the requirement established in section 311(b) of the National Defense Authorization Act for Fiscal Year 2002 for the DoD to assign a relative priority for munitions responses to each location in the inventory of DOD defense sites known or suspected of containing UXO, DMM, or MC. The DoD adopted the MRSPP under the authority of 10 USC 2710(b). Provisions of 10 USC 2710(b) require that the Department assign to each defense site in the inventory required by 10 USC 2710(a) a relative priority for response activities based on the overall conditions at each location and taking into consideration various factors related to safety and environmental hazards (70 FR 58016).

Range – A designated land or water area that is set aside, managed, and used for range activities of the DoD. The term includes firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, electronic scoring sites, buffer zones with restricted access, and exclusionary areas. The term also includes airspace areas designated for military use in accordance with regulations and procedures prescribed by the Administrator of the Federal Aviation Administration (10 USC 101(e)(1)(A) and (B)).

Range Activities – Research, development, testing, and evaluation of military munitions, other ordnance, and weapons systems; and the training of members of the armed forces in the use and handling of military munitions, other ordnance, and weapons systems (10 USC 101(e)(2)(A) and (B)).

Risk Assessment Code (RAC) – An interim risk assessment procedure developed by the U.S. Army Engineering and Support Center, Huntsville (USAESCH), Ordnance and Explosives Directorate (CEHNC-OE) to address explosives safety hazards related to munitions. The RAC score was formerly used by the USACE to prioritize response actions at FUDS. The RAC procedure, which does not address environmental hazards associated with MC, has been superseded by the MRSPP.

Unexploded Ordnance – Military munitions that (A) have been primed, fuzed, armed, or otherwise prepared for action; (B) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (C) remain unexploded either by malfunction, design, or any other cause (10 USC 101(e)(5)(A) through (C)).

1 *Executive Summary*

2 The Department of Defense (DoD) has established the Military Munitions Response Program
3 (MMRP) under the Defense Environmental Restoration Program (DERP) to address DoD sites
4 suspected of containing munitions and explosives of concern (MEC) or munitions constituents
5 (MC). Under the MMRP, the U.S. Army Corps of Engineers (USACE) is conducting
6 environmental response activities at Formerly Used Defense Sites (FUDS) for the Army, the
7 DoD Executive Agent for the FUDS program. Shaw Environmental, Inc. (Shaw) is responsible
8 for conducting Site Inspections (SIs) at FUDS in the northwest region managed by the Omaha
9 District Military Munitions Design Center (NWO).

10 *SI Objectives and Scope*

11 The primary objective of the MMRP SI is to determine whether a FUDS project warrants further
12 response action under the Comprehensive Environmental Response, Compensation, and Liability
13 Act (CERCLA). The SI collects the minimum amount of information necessary to make this
14 determination, as well as it (i) determines the potential need for a removal action; (ii) collects or
15 develops additional data, as appropriate, for Hazard Ranking System (HRS) scoring by the
16 Environmental Protection Agency (EPA); and (iii) collects data, as appropriate, to characterize
17 the release for effective and rapid initiation of the Remedial Investigation (RI) and Feasibility
18 Study (FS). An additional objective of the MMRP SI is to collect the additional data necessary
19 to complete the Munitions Response Site Prioritization Protocol (MRSPP).

20 The scope of the SI reported herein is restricted to evaluation of the presence of MEC and MC
21 related to historical use of the FUDS prior to transfer. Potential releases of hazardous, toxic, or
22 radioactive wastes (HTRW) are not addressed within the current scope. The intent of the SI is to
23 confirm the presence or absence of MEC and/or associated MC contamination.

24 *Boardman Air Force Range*

25 This report presents the results of an SI conducted at Boardman Air Force Range (AFR), FUDS
26 property number F10OR0160, located approximately 5.5 miles southwest of Boardman, Oregon,
27 in Morrow County. Boardman AFR was commissioned in 1941 and was used primarily as a
28 practice bombing and gunnery range. A small portion was also reported to be used for the
29 demolition of unserviceable/surplus munitions and small arms tracer testing. Boardman AFR
30 was decommissioned in 1963, following discussions between the Navy, the Department of the
31 Interior (DOI), and the State of Oregon, whereupon an agreement was reached where the Navy
32 would consolidate its needs to the eastern half of the original range and release the western half.
33 The land in the western half was transferred to the State of Oregon, Portland General Electric
34 (PGE), and Morrow County.

35 Technical Project Planning

36 The approach for the SI was developed by Shaw in consultation with site stakeholders. A
37 Technical Project Planning (TPP) meeting conducted in July 2006 was attended by
38 representatives from the USACE Omaha Design Center, USACE Seattle District, Oregon
39 Department of Environmental Quality (ODEQ), Oregon State Police, Portland General Electric,
40 Boardman Agri-Industrial Complex, Inc. (BAIC, Inc.), Threemile Canyon Farms, Inland Land
41 Company, The Nature Conservancy, the Boeing Company, and Shaw. The EPA Region 10 was
42 invited to attend but did not respond. The stakeholders agreed to the approach and identified six
43 areas of concern (AOCs) for further evaluation in the SI as follows: Target No. 1, Target No. 2,
44 Carty Reservoir Bomb Target, Range Complex No. 1, Demolition Area No. 2, and Impact Area.
45 Note that Demolition Area No. 2 and the Impact Area were identified during the TPP. The other
46 four AOCs were previously identified in the Archive Search Report (ASR), ASR Supplement,
47 and the DoD Annual Report to Congress.

48 It was also agreed to utilize existing analytical data collected during the *Boardman AFR FUDS*
49 *Preliminary Assessment/Site Inspection Report (PA/SI)* (Weston, 2004) in the evaluation of
50 Boardman AFR.

51 SI Field Activities

52 SI field activities, conducted in February 2007, included a visual reconnaissance at Target No. 1
53 and the Impact Area to look for evidence of MEC. At the other AOCs, fieldwork was limited to
54 sampling for MC because evidence of MEC was available from previous investigations. Prior to
55 sampling, a limited visual reconnaissance, aided by an all-metal detector, was completed for
56 anomaly avoidance during sampling. The objective of the visual reconnaissance was to observe
57 general conditions and to select sampling locations. Samples were collected from surface soil
58 and sediment.

59 SI Recommendations

60 Results of the SI provide the basis for conclusions and recommendations for further actions at
61 each of the AOCs.

62 *Target No. 1*

63 Based on historical evidence and results from the SI field activities, there is potential for MEC at
64 Target No. 1. Analytical results indicate that all soil metals results are below Boardman AFR
65 background values and no explosives were detected. Groundwater analytical results indicate that
66 metals concentrations are similar to background, with the exception of iron which was above the
67 background value but below the human health screening value. Perchlorate was not detected in
68 the groundwater sample collected from within the AOC. Based on the potential for MEC, a
69 recommendation for a Remedial Investigation/Feasibility Study (RI/FS) is made for Target
70 No. 1.

71 *Target No. 2*

72 Based on historical evidence and recent MEC finds, there is potential for MEC at Target No. 2.
73 Analytical results indicate that all soil metals results are below Boardman AFR background
74 values and no explosives were detected. While surface water analytical results indicate that
75 perchlorate is present, the upstream sampling locations have the highest perchlorate
76 concentrations, which indicate that the perchlorate is not from Target No. 2 or any other known
77 FUDS AOC. Based on the potential for MEC, a recommendation for RI/FS is made for Target
78 No. 2.

79 *Carty Reservoir Bomb Target*

80 Based on historical evidence, there is potential for MEC at Carty Reservoir Bombing Target.
81 Analytical results indicate that all soil and sediment metals analytical results are below
82 Boardman AFR background values and no explosives were detected. Surface water was
83 analyzed for perchlorate only and there was no detection. Based on the potential for MEC, a
84 recommendation for RI/FS is made for Carty Reservoir Bombing Target.

85 *Range Complex No. 1*

86 Based on historical evidence and results from the SI field activities, there is potential for MEC at
87 Range Complex No. 1. Analytical results indicate that all soil metals results are below
88 Boardman AFR background values and no explosives or perchlorate were detected, indicating no
89 observed adverse impacts from MC at Range Complex No. 1. Based on the potential for MEC, a
90 recommendation for RI/FS is made for Range Complex No. 1.

91 *Additional Recommendations*

92 Based on historical evidence and conditions observed in the SI, a removal action is not
93 recommended prior to additional investigation.

94 It is recommended that the two AOCs identified during the TPP process, the Demolition Area
95 No. 2 and the Impact Area, be designated as MRSs.

96 It is also recommended that areas where MEC has been reported, but are not included in the four
97 MRSs presented above or the two AOCs recommended for as additional MRSs, be further
98 investigated to determine whether additional MEC is present in the vicinity.

99 **1.0 Introduction**

100 This Site Inspection (SI) Report presents the results of an SI conducted at the Boardman Air
101 Force Range (AFR) Formerly Used Defense Site (FUDS) located near Boardman, Oregon (OR).
102 Shaw Environmental, Inc. (Shaw) has prepared this report for the U.S. Army Corps of Engineers
103 (USACE) in accordance with Task Order 003, issued under USACE Contract No. W912DY-04-
104 D-0010. Shaw is responsible for conducting SIs at FUDS in the Northwest Region managed by
105 the Omaha District Military Munitions Design Center (NWO) as directed by the Performance
106 Work Statement (Appendix A).

107 The technical approach is based on the *Type I Work Plan, Site Inspections at Multiple Sites,*
108 *NWO Region* (Shaw, 2006a) and the *Formerly Used Defense Sites, Military Munitions Response*
109 *Program, Site Inspections, Program Management Plan* (USACE, 2005).

110 **1.1 Project Authorization**

111 The Department of Defense (DoD) has established the Military Munitions Response Program
112 (MMRP) to address DoD sites suspected of containing munitions and explosives of concern
113 (MEC) or munitions constituents (MC). Under the MMRP, the USACE is conducting
114 environmental response activities at FUDS for the Army, the DoD Executive Agent for the
115 FUDS program.

116 Pursuant to USACE Engineer Regulation (ER) 200-3-1 (USACE, 2004a) and the *Management*
117 *Guidance for the Defense Environmental Response Program* (DERP) (Office of the Deputy
118 Under Secretary of Defense [Installations and Environment], September 2001), USACE is
119 conducting FUDS response activities in accordance with the DERP statute (10 USC 2701 et
120 seq.), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980
121 (CERCLA) (42 USC 9601), Executive Orders 12580 and 13016, and the National Oil and
122 Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300). As such, USACE
123 is conducting remedial SIs, as set forth in the NCP, to evaluate hazardous substance releases or
124 threatened releases from eligible FUDS.

125 While not all MEC/MC constitute CERCLA hazardous substances, pollutants, or contaminants,
126 the DERP statute provides DoD the authority to respond to releases of MEC and MC, and DoD
127 policy states that such responses shall be conducted in accordance with CERCLA and the NCP.

128 **1.2 Site Name and Location**

129 Boardman AFR, property number F10OR0160, is located approximately 5.5 miles southwest of
130 Boardman, OR, in Morrow County (Figure 1-1). The Boardman AFR is included in the MMRP
131 Inventory in the *Defense Environmental Programs Annual Report to Congress Fiscal Year 2006*
132 (ARC) (DoD, 2006), and in the *Archive Search Report Supplement, Former Boardman Air Force*

133 *Range, Boardman, Oregon* (ASR) (USACE, 2004b), with four identified ranges and three
 134 subranges as follows:

Range Name	Range ID	Approximate Area (acres)	UTM Coordinates* (meters)
Target No. 1	F10OR016001R01	649	N 5063404; E 279733
Target No. 2	F10OR016001R02	649	N 5072555; E 280149
Carty Reservoir Bomb Target	F10OR016001R03	649	N 5061866; E 279539
Range Complex No. 1	F10OR016001R03	9,505	N 5072555; E 280149
INPR Site No. 1	F10OR016001R03-SR01	536	N 5072555; E 280149
Demolition Area	F10OR016001R03-SR02	157	N 5072555; E 280149
Turret Gunnery Training Range	F10OR016001R03-SR03	9,443	N 5072555; E 280149

135 *Coordinates for the ranges are in UTM Zone 11N, NAD 1983.

136 Of the 649 total acres reported for the Carty Reservoir Bomb Target, the ASR Supplement
 137 indicates 325 acres were on land and 324 acres were water acres. In addition to the four ranges
 138 and three subranges, two other areas that were not identified in the range inventory, are evaluated
 139 in this SI. The two areas including coordinates are as follows:

- 140 ▪ Demolition Area No. 2 N 5065433; E 284894
- 141 ▪ Impact Area N 5059240; E 282333

142 These two additional areas were added in the *Technical Project Planning Memorandum*,
 143 *Boardman Air Force Base* (TPP Memo) (Shaw, 2006b) following discussions with stakeholders
 144 who indicated the presence of munitions debris (MD) at these locations.

145 **1.3 Purpose, Scope, and Objectives of the Site Inspection**

146 The primary objective of the MMRP SI is to determine whether a FUDS project warrants further
 147 response action under CERCLA or not. The SI collects the minimum amount of information
 148 necessary to make this determination, as well as it (i) determines the potential need for a removal
 149 action; (ii) collects or develops additional data, as appropriate, for Hazard Ranking System
 150 (HRS) scoring by Environmental Protection Agency (EPA); and (iii) collects data, as
 151 appropriate, to characterize the release for effective and rapid initiation of the Remedial
 152 Investigation and Feasibility Study (RI/FS). An additional objective of the MMRP SI is to

153 collect the additional data necessary to complete the Munitions Response Site Prioritization
154 Protocol (MRSPP).

155 The scope of the SI reported herein is restricted to evaluation of the presence of MEC or MC
156 related to historical use of the FUDS prior to transfer. Potential releases of hazardous, toxic, or
157 radioactive wastes (HTRW) are not addressed within the current scope. The intent of the SI is to
158 confirm the presence or absence of contamination from MEC and/or MC. The general approach
159 for each SI is to conduct records review and site reconnaissance to evaluate the presence or
160 absence of MEC, and to collect samples at locations where MC might be expected based on the
161 conceptual site model (CSM). The following decision rules are used to evaluate the results of
162 the SI:

163 **Is No DoD Action Indicated (NDAI)?** An NDAI recommendation may be made if:

- 164 • There is no indication of MEC;
165 and
- 166 • MC contamination does not exceed screening levels determined from Technical
167 Project Planning (TPP).

168 **Is an RI/FS warranted?** An RI/FS may be recommended if:

- 169 • There is evidence of MEC hazard. MEC hazard may be indicated by direct
170 observation of MEC during the SI, by indirect evidence (e.g., a crater potentially
171 caused by impact of unexploded ordnance [UXO]), or by a report of MEC being
172 found in the past without record that the area was subsequently cleared;
173 or
- 174 • MC contamination exceeds screening levels determined from TPP.

175 **Is a removal action warranted?** A removal action may be needed if:

- 176 • High MEC hazard is identified. Shaw will immediately report any MEC findings
177 so that USACE can determine the hazard in accordance with the MRSPP. An
178 example of a high hazard would be finding sensitive MEC at the surface in a
179 populated area with no barriers to restrict access;
180 or
- 181 • Elevated MC risk is identified. Identification of a complete exposure pathway
182 (e.g., confirming MC concentrations above health-based risk standards in a water
183 supply well) would trigger notification of affected stakeholders. Data would be
184 presented at a second TPP meeting regarding the possible need for a removal.

185 For purposes of applying these decision rules, USACE has provided guidance that evidence of
186 MEC will generally be a basis of recommending RI/FS. Evidence of MEC may include
187 confirmed presence of MEC from historical sources or SI field work, or presence of MD.

188 **1.4 *Munitions Response Site Prioritization Protocol***

189 The MRSPP was published as a rule on October 5, 2005 (70 FR 58028). This rule implements
190 the requirement established in section 311(b) of the National Defense Authorization Act for
191 Fiscal Year 2002 for the DoD to assign a relative priority for munitions responses to each
192 location in the DoD inventory of defense sites known or suspected of containing UXO, discarded
193 military munitions, or MC (70 FR 58016).

194 Draft MRSPP scoring sheets for the munitions response sites (MRSs) identified in this SI Report
195 are included in Appendix K. The MRSPP scoring will be updated on an annual basis to
196 incorporate new information.

197 *2.0 Property Description and History*

198 The setting, history, and use of Boardman AFR are described in the following sections. Unless
199 otherwise referenced, this information is taken from the ASR (USACE, 1997).

200 *2.1 Historical Military Use*

201 Boardman AFR (Figure 2-1) was used primarily as a practice bombing and gunnery range.
202 According to the ASR, beginning in 1941 and continuing through 1943, the United States Army
203 Air Corps acquired 95,985.51 acres through purchase of private land and transfer of Department
204 of the Interior (DOI) land for a practice bombing and gunnery range. Throughout the World War
205 II years, it was used for bombing practice by the Walla Walla Army Air Base. After World War
206 II, the Army Air Corps categorized the bombing range as surplus land and by 1946 discussions
207 were held concerning authorizing livestock grazing on the inactive range. However, in 1948, the
208 lands were withdrawn from surplus and the Air Force used the range until to 1960. Renamed the
209 Boardman Precision Bombing Range, the range was configured with five targets and exclusion
210 areas.

211 The 57th Air Division, Fairchild Air Force Base, assumed responsibility, control, and utilization
212 of the former Boardman AFR between 1952 to 1957. Records indicate that a “moving 20-
213 millimeter (mm) target gunnery range, with three mounted B-36 turrets, was added in 1952. The
214 gunners fired at remote controlled aerial target drones (OQ aircraft) under daylight and night
215 conditions. Practice bombing was also occurring during this time. Target No. 2 was the
216 principal bomb target during this time”.

217 The historical records do not indicate how the area was used between 1956 and 1958. However,
218 in December 1958, the Air Force granted the Department of the Navy permission to use the
219 bombing range site as a high altitude bombing range. Also, in 1960, the Umatilla Army
220 Ordnance Depot was granted a permit to use two small areas for the destruction of unusable
221 munitions and small arms ammunition tracer testing.

222 In 1960, once again the Air Force placed the former Boardman AFR in an excess category and
223 transferred 37,320.31 acres to the DOI, 58,372.9 acres to the Navy, and 290 acres to the USACE.

224 In 1963, following discussions between the Navy, the DOI, and the State of Oregon, an
225 agreement was reached where the Navy would consolidate its needs to the eastern half of the
226 original range and release the western half. This allowed for single contiguous land use by the
227 Navy and DOI. The Air Force then passed ownership on to the State of Oregon and other
228 entities.

229 **2.2 Munitions Information**

230 The types of munitions used at Boardman AFR would have included 100-pound (lb) practice
231 bombs, 2- and 4-lb incendiary bombs, 2.25-inch practice rockets, fragmentation bombs, and
232 conventional small arms (.50-caliber or less) and 20-mm ball ammunition. Table 2-1 contains a
233 list of the munitions and associated MC reportedly used at the Areas of Concern (AOCs).

234 **2.3 Ownership History**

235 Originally the former Boardman AFR occupied approximately 95,985 acres. In 1960, the Air
236 Force declared the property surplus and portions of the bombing range were transferred to the
237 DOI, USACE, and Department of the Navy (Navy). The parcels transferred to the DOI and the
238 Navy were aligned in a checkerboard pattern. In 1963, the area was split into two parcels, with
239 the Navy controlling the eastern portion and the State of Oregon owning the western portion.
240 The USACE maintained ownership of a small parcel (approximately 290 acres) along the
241 Columbia River. After the property redistribution, the former Boardman AFR FUDS occupies
242 an area of approximately 48,976 acres.

243 Following closure of the Boardman AFR, the land was transferred from the Air Force to the
244 State of Oregon, Portland General Electric, and Morrow County. Currently the property within
245 the former Boardman AFR FUDS is owned by the City of Boardman, Morrow County,
246 Boardman Agri-Industrial Complex, Inc. (BAIC, Inc.), and Portland General Electric (PGE).
247 Presently BAIC, Inc. leases land to PGE, the Boeing Company, Inland Land Company, and The
248 Nature Conservancy. Figure 2-2 shows the area surrounding Boardman AFR from an aerial
249 photograph perspective. Parcel ownership within the identified range areas is shown on Figure
250 2-3. The property owners are identified by an index number rather than a name on the figures.
251 The property owner name is available on request from the USACE Seattle District office.

252 **2.4 Physical Setting**

253 **2.4.1 Topography and Vegetation**

254 The topography of the former Boardman AFR slopes gently up from the Columbia River
255 (approximately 310 feet [ft] elevation) near the northern boundary of the FUDS to the southern
256 boundary at about 1,000 ft elevation (Figure 2-4).

257 The native vegetation of the Boardman AFR is shrub-steppe, with wild grasses and small brush
258 including sage and grey rabbit bush.

259 **2.4.2 Land Use**

260 The FUDS is currently used for irrigated agricultural and grazing purposes; farming of potatoes,
261 onions, and other vegetables; as a restricted antennae test range operated by the Boeing
262 Company; as a fossil fuel power generating plant owned by PGE; as a habitat management area
263 for the protection of the Washington Ground Squirrel managed by The Nature Conservancy; and
264 as an airstrip operated and maintained by the Morrow County Port Authority.

265 **2.4.3 Nearby Population**

266 The community nearest the former Boardman AFR is Boardman, OR, with an estimated
267 population of 2,855 (U.S. Census, 2000) (Figure 2-5). Morrow County has an estimated
268 population of 10,995 or 5.4 people per square mile (U.S. Census, 2000). Several hundred
269 residences and numerous farms are located within a two mile radius of the FUDS. Two schools
270 are located approximately 2 miles northeast of the FUDS (Figure 2-6). Based on the 2000 U.S.
271 Census, the estimated population within a 4-mile radius of the Boardman AFR FUDS property
272 boundary is 3,432 persons. The estimated numbers of housing units and households within a 4-
273 mile radius are 1,162 and 1,049, respectively.

274 The estimated population within a 2-mile radius for each of the four ranges listed in the 2006
275 ARC (DoD, 2006) are: Target No 1 – 0 persons, Target No. 2 – 0 persons, Carty Reservoir
276 Bomb Target – 0 persons, and Range Complex No. 1 – 63. There are no schools or other critical
277 assets located within a 2-mile radius of any of these four ranges.

278 **2.4.4 Climate**

279 The climate in the Boardman area is semi-arid. It is warm and dry in the summer and cool and
280 dry in the winter. The wettest month is generally December and with the driest month is July.
281 The highest monthly average maximum temperature is 89.7 degrees Fahrenheit (°F) in July and
282 the lowest monthly average maximum temperature is 27 °F in January. The average annual
283 precipitation is 8.41 inches per year.

284 **2.4.5 Area Water Supply**

285 Local drinking water is obtained from individual domestic water wells at residences. Well
286 depths range from 80 to 300 ft., and are typically completed in the basalt aquifer. The City of
287 Boardman obtains water from a well located adjacent to the Columbia River. Within the
288 Boardman AFR FUDS there is one water supply well for the PGE fossil fuel power generating
289 plant. This well serves both industrial and drinking water needs for the power plant. Irrigation
290 water is obtained either from groundwater wells or the Columbia River. Figure 2-7 shows
291 groundwater wells in the vicinity of Boardman AFR.

292 **2.4.6 Surface Water**

293 The former Boardman AFR is located within the Middle Columbia-Lake Wallula Watershed.
294 Figure 2-8 shows the regional surface water drainages. Carty Reservoir is located within the
295 former Boardman AFR and portions of the Target No. 1 and Carty Reservoir AOCs are
296 submerged under the reservoir. Carty Reservoir was created when PGE dammed a portion of
297 Sixmile Canyon Creek in 1977. The reservoir level is maintained using water pumped from the
298 Columbia River. There is no surface water outlet from the reservoir. Sixmile Canyon Creek
299 traverses across the western portion of the former Boardman AFR. The creek is not known to
300 support fisheries. Historically the creek was dry except during periods of heavy rain and snow
301 melt. With the creation of Carty Reservoir and the resulting groundwater mound, water now is

302 present in Sixmile Canyon Creek. The creek flows into the Columbia River, which is a major
303 river that supports both federally and state threatened and listed species.

304 **2.4.7 Geologic and Hydrogeologic Setting**

305 The former Boardman AFR lies within the Columbia Basin Subprovince of the Columbia
306 Intermontane Physiographic Province.

307 **2.4.7.1 Bedrock Geology**

308 The bedrock beneath the Boardman AFR consists of basalt flows of the Columbia River Basalt
309 Group. Individual basalt flows range in thickness from a few tens of feet to several hundred feet.
310 Interflow zones between individual flows may contain fine-grained sediments and are productive
311 water-bearing zones, frequently producing high volumes of water for irrigation purposes. A
312 layer of alluvium overlies the basalt flows and ranges in thickness from absent up to 70 feet.

313 **2.4.7.2 Overburden Soils**

314 The soils at the former Boardman AFR are composed of four different soil groups: the Quincy
315 loamy fine sand, the Koehler loamy fine sand, the Hezel loamy fine sand, and the Tauton fine
316 sandy loam.

317 **2.4.7.3 Hydrogeology**

318 Groundwater occurs within two distinct aquifers, the alluvial aquifer and the Columbia River
319 Basalt aquifer system. Based on documentation received from PGE and included in
320 *Hydrogeology, Groundwater Chemistry, and Land Use in the Lower Umatilla Basin*
321 *Groundwater Management Area* (ODEQ, 1995), prior to construction of Carty Reservoir by PGE
322 in 1977 only thin occurrences of groundwater within the alluvium were reported and Sixmile
323 Canyon Creek was dry. Leakage from Carty Reservoir has resulted in a perched groundwater
324 zone above the uppermost basalt flow. Water levels in the alluvium were observed to rise up to
325 30 ft (40 ft below ground surface) in wells constructed near Carty Reservoir. The water levels
326 have now stabilized. There appears to be a groundwater mound beneath Carty Reservoir.
327 Groundwater flow direction for both the alluvial aquifer and the Columbia River Basalt aquifer
328 system is to the north toward the Columbia River.

329 There are no private irrigation wells, two industrial water source wells and several monitoring
330 wells located within the former Boardman AFR (mostly associated with the PGE fossil fuel
331 power plant).

332 **2.4.8 Sensitive Environments**

333 The ranges and other areas do qualify as Important Ecological Places (IEPs) or sensitive
334 environments as defined by USACE (2006) or EPA (1997) and shown in Table 2-2. An
335 exception to this is Target No. 2 which is used entirely for agricultural purposes and does not fit
336 the definition of an IEP. Portions of the ranges and other areas of interest at the Boardman AFR
337 addressed by this SI are used for agricultural and industrial purposes as well as a wildlife

338 management area for the protection of the Washington Ground Squirrel by The Nature
339 Conservancy under a multi-species candidate conservation agreement (Figure 2-6). The
340 Washington Ground squirrel is a state listed endangered species and a federal candidate species.
341 Portions of Boardman AFR are within the Three-Mile Canyon Farms Multi-Species Candidate
342 Conservation Agreement with Assurances area created by the U.S. Fish and Wildlife Service in
343 cooperation with the Oregon Department of Fish and Wildlife, The Nature Conservancy, and
344 PGE. The agreement contains a strategy for managing lands used by the Washington Ground
345 Squirrel and to preclude the need to federally list the species as threatened or endangered. These
346 lands are managed by The Nature Conservancy and are shown on Figure 2-6.

347 *2.5 Previous Investigations for MC and MEC*

348 During the ASR site visit, MD was reported within Target No. 2, Carty Reservoir Bomb Target,
349 and INPR Site No. 1. A range clearance was reportedly completed in the 1954-1955 timeframe
350 (ASR, 1997, Appendix I).

351 MEC has been reported recently as March 2006 at Target No. 2 AOC. These reports were made
352 following the discovery of six AN-M57 General Purpose (GP) practice bombs (capable of
353 detonating) at a local recycler. These six bombs and fifteen additional AN-M57 GP practice
354 bombs recovered from a pile accumulated from Target No. 2 were detonated by a Navy
355 explosive ordnance disposal (EOD) team at the nearby Navy Bombing Range. According to
356 reports from the Navy EOD the bombs were training bombs. The bombs had been gathered from
357 agricultural fields and placed in a pile by the agricultural workers.

358 MEC and MD were reported to the Oregon State Police in the June 2006 at Demolition Area No.
359 2. The MEC and MD consisted of an M83 Butterfly Bomb, M66 or M68 Base Detonating Fuze
360 for 75-mm or 90-mm projectiles, and a 100-pound (lb) GP Bomb base plate. The Oregon State
361 Police Bomb Squad destroyed these munitions.

362 *2.5.1 Archives Search Report*

363 The USACE completed an ASR in 1997, which compiled available information for the former
364 Boardman AFR with emphasis on types and areas of ordnance use and disposal (USACE, 1997).

365 *2.5.2 ASR Supplement*

366 The USACE completed an ASR Supplement in 2004 identified specific ranges (Target No. 1,
367 Target No. 2, Carty Reservoir Bomb Target, and Range Complex No. 1 [INPR Site No. 1,
368 Demolition Area, and Turret Gunnery Training Range]).

369 *2.5.3 Other Investigations*

370 The USACE prepared an Inventory Project Report (INPR) for the former Boardman AFR in
371 September 1992, in which a potential hazard from UXO at the FUDS was identified.

372 A Risk Assessment Code (RAC) scoring was conducted by the USACE in 2004 for the ranges
 373 identified in the ASR Supplement. Possible scores range from 5 (low risk) to 1 (high risk). The
 374 following table summarizes the RAC determinations for the ranges and indications of whether
 375 MEC has been found at these AOCs since the end of training activities, as summarized in the
 376 ASR Supplement:

AOC	RAC Score	MEC Found
Target No. 1	4	No
Target No. 2	4	Yes
Carty Reservoir Bomb Target	4	Yes
Range Complex No. 1	4	Yes

377 Weston Solutions Inc. (Weston) conducted a Preliminary Assessment/Site Inspection (PA/SI) for
 378 the EPA at the former the former Boardman AFR in 2004. The results of the investigation are
 379 presented in *Boardman AFR FUDS Preliminary Assessment/Site Inspection Report* (Weston,
 380 2004). The scope of the PA/SI largely paralleled the scope of this SI. However, a greater
 381 emphasis was placed on determining the presence of perchlorate in soil and groundwater within
 382 and around the Boardman AFR FUDS. To the extent possible, this MMRP SI used data
 383 previously collected for the PA/SI. Additional reconnaissance and sampling activities were
 384 planned only to address specific data needs identified during the TPP. The PA/SI collected
 385 samples from soil, sediment, surface water, and groundwater. Table 2-3 lists the samples
 386 collected and analyses completed. Samples were analyzed for Target Analyte List (TAL) metals,
 387 explosives, and perchlorate. The PA/SI sample locations are shown on Figure 2-9. Note that
 388 many of the groundwater samples were collected off FUDS property.

389 The collection and analysis of environmental samples for perchlorate during the PA/SI were
 390 performed in accordance with an EPA Region 10 approved Sampling and Quality Assurance
 391 Plan (SQAP) prepared by Weston. Environmental samples analyzed for perchlorate employed
 392 EPA Method 314.0 (Ion Chromatography) (IC). Additionally, several surface water and
 393 groundwater samples employed a combination of EPA Method 314.0 and SW-846 Method
 394 8321A Modified (Liquid Chromatography/Mass Spectroscopy). Perchlorate analyses by EPA
 395 Method 314.0 are susceptible to false positives because of the non-specificity of the conductivity
 396 detector. Therefore, all perchlorate “hits” (detects) reported by EPA Method 314.0 may be
 397 biased high because of positive matrix interference. In cases where the sample was analyzed by
 398 both EPA Method 314.0 and SW-846 Method 8321A Modified, Shaw reported the perchlorate
 399 result from the EPA SW-846 Method 8321A Modified analysis. This is because EPA SW-846
 400 Method 8321A Modified provides greater method sensitivity and minimizes the possibility of

401 false positives. The table below summarizes perchlorate results reported by both EPA Method
 402 314.0 and SW-846 Method 8321A Modified, and Weston’s calculated relative percent difference
 403 (RPD) values. A low RPD value indicates good reproducibility or precision between
 404 perchlorate results analyzed by both EPA Method 314.0 and SW-846 Method 8321A Modified.

Sample ID	EPA Method 314.0 Result (µg/L)	EPA SW-846 Method 8321A Modified Result (µg/L)	Relative Percent Difference (RPD)
GW-DW002	< 1.0	0.46	NC
GW-MW007	3.84	4.2	9
GW-MW012	<1.0	1.1	NC
GW-MW017	20.7	18	14
GW-MW20	9.73	9.8	1
GW-MW022	5.85	5.9	1
GW-MW0023	2	2.5	22
SW-SC001	<1.0	0.32	NC

405 µg/L = micrograms per liter
 406 < = concentration less than indicated quantity
 407 EPA = U.S. Environmental Protection Agency
 408 NC = not calculated
 409  = shaded samples indicate samples from locations off-site of Boardman AFR FUDS

410 Although perchlorate results analyzed by EPA Method 314.0 may be biased high, the data were
 411 collected and reported in accordance with EPA guidance and are assumed to be of acceptable
 412 quality. The reported analyte “detections” may be used for the purpose of comparing analyte
 413 concentrations against screening levels. All perchlorate results reported above the laboratory’s
 414 EPA Method 314.0 detection limit for the PA/SI are below Shaw’s SI human health screening
 415 value of 24.0 ug/L (DoD Perchlorate Screening Value).

416 The PA/SI report concluded that no samples contained significant (three times the PA/SI
 417 background concentration) concentrations of metals and no explosive compounds were detected.
 418 Perchlorate was detected in all five surface water samples from Sixmile Canyon Creek, with
 419 concentrations ranging between 0.32 micrograms per liter (µg/L) and 7.49 µg/L. Perchlorate
 420 was not detected in the surface water sample collected from Carty Reservoir. Perchlorate was
 421 detected in 18 of 25 groundwater samples collected from within and surrounding Boardman AFR
 422 and ranged in concentration between 0.46 µg/L and 20.7 µg/L. Perchlorate was detected in two
 423 of the four samples collected from wells located on the Boardman AFR at concentrations of 2.5
 424 µg/L and 3.56 µg/L. Note the DoD action level for perchlorate is 24 µg/L.

425 Additional groundwater and surface water sampling has been completed in the lower Umatilla
 426 Basin by the EPA, ODEQ and the Navy confirming the presence of perchlorate in groundwater
 427 and surface water throughout the Lower Umatilla Basin, within which the former Boardman

428 AFR FUDS resides (ODEQ, 2006). Locations with perchlorate detections occur both cross (up
429 to tens of miles) and down gradient of the former Boardman AFR. The source or sources of the
430 perchlorate have not been identified and the ODEQ and EPA are continuing investigations of
431 perchlorate impacts in the Lower Umatilla Basin.

432 *2.6 Other Land Uses that May Have Contributed to Contamination*

433 Agricultural use of pesticides and herbicides could have also contributed to media contamination
434 in particular relative to perchlorate. Perchlorate containing compounds have been documented in
435 historical uses of fertilizers and herbicides. In addition, arid climate soils have been found to
436 contain naturally occurring perchlorate (ITRC, 2005)

437 *2.7 Past Regulatory Activities*

438 There have been no regulatory actions with respect to MEC or MC reported for the site.

439 *2.8 Previous MEC Finds*

440 MEC finds, cited in the 1997 Boardman ASR and other more recent finds, are listed on Table 2-4
441 and shown on Figure 2-10. Several of the MEC finds are not located within defined AOCs.
442 These finds may be the result of errant bomb releases or the MEC may have been moved to the
443 location from another within a known AOC.

444 3.0 *SI Tasks and Findings*

445 SI tasks conducted for this FUDS property involved compiling and reviewing historical reports
446 and information, using this information in the subsequent TPP and overall SI process. Following
447 the TPP meeting, the *Final Site-Specific Work Plan, Boardman Air Force Range (SSWP)* (Shaw,
448 2007) was prepared to define the SI field activities necessary to collect the information needed to
449 address the data gaps and data quality objectives (DQOs). Field work was conducted at the
450 Boardman AFR between February 26 and 28, 2007.

451 3.1 *Technical Project Planning*

452 TPP involved compiling and reviewing historical reports and information to identify data gaps
453 and develop a path forward. The TPP meeting for the former Boardman AFR was held at the
454 Port of Morrow Riverfront Center in Boardman, Oregon on July 20, 2006. Representatives from
455 the USACE – Omaha Design Center and Seattle District, ODEQ, Oregon State Police, PGE,
456 BAIC Inc., Threemile Canyon Farms, Inland Land Company, The Nature Conservancy, the
457 Boeing Company, and Shaw were in attendance. EPA Region 10 was invited to attend but did
458 not respond.

459 Shaw reviewed the Boardman AFR information and presented a summary of the FUDS and the
460 proposed approach for the SI, addressing MEC and MC sampling. All parties were in general
461 agreement with the approach, but reserved judgment until the draft *Technical Project Planning*
462 *Memorandum, Boardman Air Force Base* (TPP Memo) (Shaw, 2006b) was issued. The property
463 owners and lessees agreed to act on the requests for rights of entry (ROE) after they receive the
464 draft TPP Memo.

465 Based on the TPP meeting and subsequent evaluation of data obtained at the meeting, six AOCs
466 are identified and addressed in the TPP Memo (Shaw, 2006b) and this report. The six AOCs are
467 Target No. 1, Target No. 2, Carty Reservoir Bomb Target, Range Complex No. 1 (includes INPR
468 Site No. 1, Demolition Area, and Turret Gunnery Training Range), Demolition Area No. 2, and
469 the Impact Area. Note that the Impact Area was identified after the TPP meeting, following
470 evaluation of aerial photos.

471 TPP meeting results were documented in the TPP Memo (Shaw, 2006b), which was issued final
472 on November 27, 2006 after incorporating comments from the stakeholders. The proposed
473 technical approach was defined in the SSWP (Shaw, 2007), which was issued final on February
474 8, 2007 after incorporating comments from the stakeholders. A more complete discussion of the
475 TPP meeting is contained in TPP Memo (Shaw, 2006b) provided as Appendix B.

476 Specific discussions during the meeting included:

477 **AOCs:** There was agreement on the AOCs presented: Target No. 1, Target No. 2, Carty
478 Reservoir Bomb Target, Range Complex No. 1 (INPR Site No.1, Demolition Area, and Turret
479 Gunnery Training Range). Demolition Area No. 2 was identified during the meeting. The SI
480 AOCs are shown on Figure 3-1. Note that the boundary for Demolition Area No. 2 is dashed
481 because the extent of the AOC has not been verified. The dashed boundary does include the
482 known extent of demolition craters observed on aerial photography.

483 Potential AOC(s) were discussed based on information provided by The Nature Conservancy
484 where MEC or MD have been located in areas within the FUDS boundary south of Demolition
485 Area No. 2. Additional air photo review of this area is warranted along with evaluation of
486 materials (topographic maps with MEC and MD locations) provided by The Nature Conservancy
487 on lands they manage. Following review of data obtained at the TPP Meeting from The Nature
488 Conservancy, an additional AOC, the Impact Area, was added. The extent of the Impact Area is
489 not known and therefore no boundary is placed on Figure 3-1 or other figures presented in this
490 report.

491 A firing target for the Turret Gunnery Training Range, which is part of Range Complex No. 1,
492 was noted by a representative of The Nature Conservancy as being within the FUDS boundary.
493 He stated that the target was an old car, making it a potential sampling location for projectiles.
494 The car is no longer present at the site.

495 **Property Ownership:** Ownership was clarified in the meeting. Much of the property is owned
496 by BAIC, Inc. which leases the area for farming, grazing, resource management, and scientific
497 research. Lessees include Inland Land Company, Threemile Canyon farms, the Boeing
498 Company, The Nature Conservancy, and PGE.

499 **Air Photo Imagery:** ODEQ has 2006 imagery available, which they provided following the
500 meeting.

501 **Sampling:** ODEQ would like to have one of the samples collected from Target No. 1 and Carty
502 Reservoir Bomb Target also analyzed for explosives. The rationale is to demonstrate that no
503 explosives, other than black powder, were used at either of these targets.

504 **Background Sampling:** ODEQ agreed to provide available soil data from area (that may be
505 used as background soil data. ODEQ provided background data, and these data were reviewed
506 for applicability and completeness. The data were mostly based on x-ray fluorescence analytical
507 methods and reported as oxide percentages. X-ray fluorescence analytical methods do not
508 produce data that are directly comparable to methods used in this SI and were not used to
509 develop background concentrations.

510 As discussed during the TPP meeting and documented in the TPP Memo (Shaw, 2006b), the
511 following project objectives and DQOs were developed.

512 **Objective 1: Determine if the site requires additional investigation or can be recommended**
513 **for NDAI based on the presence or absence of MEC.**

514 DQO #1 – Utilizing trained UXO personnel and handheld all-metal detectors, a visual
515 reconnaissance survey of Target No. 1 and the Impact Area, consisting of four transects each,
516 will be conducted to identify physical evidence to indicate the presence of MEC (e.g., MEC on
517 the surface and MD). The visual search will consist of a meandering path within the primary
518 target area. The following decision rules will apply:

- 519 ▪ If no evidence of MEC (non-small arms, MD, or magnetic anomalies was found during
520 prior investigations and none is observed during SI visual reconnaissance, the site will be
521 considered a potential candidate for No Department of Defense Action Indicated (NDAI)
522 with respect to MEC hazard.
- 523 ▪ If MEC is not found, but isolated MD or magnetic anomalies were identified during prior
524 investigations or are identified during SI visual reconnaissance, the site will be
525 considered a potential candidate for NDAI with respect to MEC hazard.
- 526 ▪ If MEC was found and/or if abundant or concentrated areas of MD or magnetic
527 anomalies were observed during prior investigations or during SI visual reconnaissance,
528 the site will be considered a potential candidate for further investigation with respect to
529 MEC hazard.
- 530 ▪ If any evidence is identified that is inconsistent with the CSM for the site (e.g., if MD
531 indicating the potential use of high explosive (HE) munitions at a site for which the CSM
532 was based on practice munitions), the above decision rules will be revised appropriately.
- 533 ▪ If there is indication of an imminent MEC hazard, the site may be recommended for a
534 removal action.

535 DQO #2 – Decision for recommending proceeding to RI with respect to MEC can be made for
536 Target No. 2, Carty Reservoir Bomb Target, Range Complex No. 1, and Demolition Area No. 2.

537 **Objective 2: Determine if the site requires additional investigation or can be recommended**
538 **for NDAI based on the presence or absence of MC above screening values.**

539 DQO #3 – Soil samples will be collected and analyzed as proposed in the SSWP (Shaw, 2007) at
540 Target No. 1, Target No. 2, Carty Reservoir Bomb Target, the Range Complex No. 1,
541 Demolition Area, Demolition Area No. 2, and the Impact Area. Analytical results will be
542 compared to screening values for human health and ecological risk assessment and to
543 background and ambient samples collected during the PA/SI and ODEQ supplied soil
544 background data set for naturally occurring substances (note that additional samples were
545 identified for the Turret Gunnery Training Range following a reviewer comment). The
546 following decision rules will apply:

- 547 ▪ If sample results are less than background, or greater than background and less than
548 human health and ecological screening values, the site will be recommended for NDAI
549 relative to MC.

- 550 ▪ If sample results exceed both human health screening values and background values, the
551 site will be recommended for additional investigation.
- 552 ▪ If sample results do not exceed human health screening values but do exceed both
553 ecological screening values and background values, additional evaluation of the data will
554 be conducted in conjunction with the stakeholders to determine if additional investigation
555 is warranted.

556 **Objective 3: Obtain data required for HRS scoring.**

557 Data required for HRS scoring are identified in the HRS Data Gaps worksheet.

558 **Objective 4: Obtain data required for MRSP ranking.**

559 Data required for MRSP ranking are identified in the MRSP worksheet.

560 **3.2 Additional Records Research**

561 **3.2.1 Coordination with State Historic Preservation Office**

562 The Oregon State Historic Preservation Office (SHPO) was contacted to determine if there are
563 any areas of cultural or archaeological significance on FUDS property that could be impacted by
564 field activities or future activities. The SHPO responded that while known archeological sites
565 are located within the project boundaries, none of the sites is within an area proposed for
566 sampling. Two general areas were identified to be within two of the sections contained in Target
567 No. 1 and Carty Reservoir Bomb Target AOCs. In addition, a 7-mile stretch of the Oregon Trail
568 crosses the extreme southern portion of the former Boardman AFR and has been labeled as “a
569 high potential segment” for archeological resources (Oregon SHPO, 2006; Appendix C).

570 The USACE Seattle District contacted the Confederated Tribes of the Umatilla Indian
571 Reservation (CTUIR) concerning SI field activities. It was agreed that if any items of cultural
572 significance were identified during field activities, the CTUIR Cultural Resources organization
573 would be notified promptly.

574 **3.2.2 Coordination with Natural Resources Offices**

575 The Oregon Department of Fish and Wildlife (ODFW) was contacted to determine if there are
576 threatened or endangered species that could be impacted by field activities or future activities at
577 the former Boardman AFR. The ODFW indicated that only the Washington Ground Squirrel
578 would be potentially impacted. They recommended that the field team work closely with The
579 Nature Conservancy, who manages the wildlife recovery area on the FUDS, to avoid impacts
580 (ODFW, 2007; Appendix C).

581 **3.2.3 Historical Aerial Photographs**

582 Historical aerial photographs from 1958 and 1965 were reviewed prior to preparation of this SI.
583 The review confirmed the locations of AOCs addressed in this SI. Copies of historical aerial
584 photographs are provided in Appendix L.

585 The most recent aerial photography is from 2006. Based on a review of the most recent aerial
586 photography coverage, the estimated number of buildings within a 2-mile radius of the ranges
587 listed in the 2006 ARC (DoD, 2006) are: Target No. 1 – 54 buildings, Target No. 2 – 11
588 buildings, Carty Reservoir Bomb Target – 54 buildings, and Range Complex No. 1 – 79
589 buildings.

590 **3.2.4 Environmental Database Search**

591 A search of available environmental records was conducted by Environmental Data Resources,
592 Inc. (EDR) (2006). The government records search met the requirements of ASTM Standard
593 Practice for Environmental Site Assessments (ASTM, 2006). Search results indicated the
594 Boardman AFR was included in several databases including:

- 595 • Formerly Used Defense Sites
- 596 • Oregon Environmental Cleanup Site information System
- 597 • Facility Index System/Facility Registry System

598 The AOCs did not appear on mapped sites in known federal, state, or local ASTM or ASTM
599 Supplemental databases (Appendix L). There are 12 Resource Conservation and Recovery Act-
600 Small Quantity Generators in the vicinity of the AOCs (not within the AOC acreages).

601 Additional information on the databases searched and the results for surrounding properties is
602 included in the EDR report found in Appendix L.

603 **3.2.5 Rights of Entry**

604 Prior to mobilizing to the site, the Project Manager for the USACE Seattle District office
605 obtained the Right of Entry for the property where the SI field activities were performed.

606 **3.3 Field Work**

607 SI field activities, conducted the week of February 26, 2007, included visual reconnaissance,
608 collection of surface soil and sediment samples. The following conditions were recorded in the
609 field log book (Appendix D) and/or by digital photographs (Appendix E):

- 610 • Presence or absence of evidence of MEC,
- 611 • Changes, if any, in sample location because of field constraints,
- 612 • Vegetative cover, and
- 613 • Presence or absence of water for sediment samples, and other conditions encountered that
614 impacted sample collection.

615 **3.4 Sampling and Analysis**

616 Samples were collected and analyzed in accordance with the SSWP (Shaw, 2007) using the
617 standard operating procedures (SOPs) from the *Type 1 Work Plan, Site Inspections at Multiple*
618 *Sites, NWO Region* (Shaw, 2006a). Table 3-1 summarizes the soil and sediment sampling
619 completed at Boardman AFR. Laboratory analysis was performed by GPL Laboratories of

620 Frederick, Maryland using methods defined in the SSWP. Analytical results are provided in
621 Appendix F. Samples were analyzed for metals using EPA SW-846 Method 6020A and
622 explosives using EPA SW-846 Method 8330A.

623 **3.5 Laboratory Analysis and Data Quality Review**

624 Laboratory analysis was performed by GPL Laboratories of Frederick, Maryland, using methods
625 defined in the SSWP. Analytical results are provided in Appendix F.

626 The data review process presented in this report compares sample results to pre-established
627 criteria referenced in the Sampling and Analysis Plan (SAP) (Shaw, 2006a, Appendix E) to
628 confirm that the data are of acceptable technical quality. GPL Laboratories, LLLP (GPL)
629 provided Shaw with a Level 4 data package including “CLP-Like” summary forms, Staged
630 Electronic Data Deliverables (SEDD) Stage 2b (version Draft 5.0), and Automated Data Review
631 (ADR) compatible A1, A2, & A3 files for all sample delivery groups (SDGs).

632 Shaw conducted a data assessment on all samples collected in support of this SI. One-hundred
633 percent of the analytical data have been reviewed and validation qualifiers assigned based on
634 EPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data
635 Review, October 1999 and EPA CLP National Functional Guidelines for Inorganic Data Review,
636 October 2004. Automated Data Review (ADR) software Version 8.1 was used to assist in the
637 data validation process for all areas with the exception of initial calibration blanks (ICB) /
638 continuing calibration blanks (CCB), interference check standards, internal standards, serial
639 dilutions, and second-column confirmation which were assessed manually. Data were evaluated
640 against specific criteria to verify the achievement of all precision, accuracy, representativeness,
641 completeness, comparability, and sensitivity goals established to meet the project DQOs.

642 The overall quality of the data collected is discussed in the Analytical Data QA/QC Report
643 (Appendix G). Results of the analyses as discussed in the Analytical Data QA/QC Report are
644 indicative of the media analyzed with the exception of some molybdenum and mercury analyses.
645 A number of the soil and sediment samples were qualified as “U” not detected due to continuing
646 calibration blank contamination and a number of the mercury analyses in the soil background
647 samples were qualified as “U” not detected due to method blank contamination. No data were
648 qualified “R” as unusable. Overall, the data reflect expected conditions and they are fully usable
649 for their intended purpose.

650 **3.6 Screening Values**

651 The following subsections describe development of background and screening values for this SI.

652 **3.6.1 Background Data**

653 Ten background soil samples were collected from the Boardman AFR area during the SI and
654 analyzed for metals. Background sample locations are shown on Figure 3-2. The selection of

655 the soil background locations was aided by Visual Sampling Plan (VSP) (PNNL, 2005). VSP is
656 a computer software program that allows for an independent sampling location selection across a
657 designated area. The area provided to the VSP software was all areas within the FUDS boundary
658 not included in a known AOC. After VSP identified potential sampling locations, the locations
659 were adjusted by hand to place the background sample location on a property for which the
660 USACE had a signed ROE. Background sediment sampling locations were collected from a
661 location upstream of the Boardman AFR AOCs.

662 The background soil sample analytical results were used to calculate background metal soil
663 concentrations using published EPA Guidance (1989, 1992, 1994, 1995, and 2006). The
664 background concentrations are either a 95th upper tolerance limit (UTL) for normally and
665 lognormally distributed analytes or the 95th percentile for nonparametric distributed analytes.
666 The background soil sample analytical results are provided in Appendix G. Table 3-2 lists the
667 soil, sediment and groundwater metals background concentrations used in this report. Table 3-2
668 also includes the background concentration for perchlorate in groundwater that was obtained
669 during the PA/SI (Weston, 2004). A summary of the soil background calculations is presented in
670 Appendix L.

671 One sediment background sample (NWO-030-5011) was collected in the vicinity of Boardman
672 AFR (Figure 3-2) during the SI and analyzed for metals. The analytical results are presented in
673 Appendix G.

674 Groundwater background concentrations were from samples collected from PGE well “120”
675 located upgradient of the Target No. 1 and Carty Reservoir AOCs. The well location is shown
676 on Figure 3-2. Metal background concentrations were obtained from the PGE Boardman Plant
677 2005 Water Quality Monitoring Report. A copy of the report is provided in Appendix L. PGE
678 monitors for all metal analytes of concern except mercury and perchlorate. The perchlorate
679 background concentration was obtained from the PA/SI report (Weston, 2004). Note that the
680 PA/SI identified the sample location as GW-MW025, which is the same well as PGE well “120.”
681 The groundwater background concentrations are listed on Table 3-2.

682 The method for comparing sediment and groundwater results to background was not defined in
683 the TPP process. For purposes of comparison in this SI, the background concentrations for
684 sediments and groundwater are taken to be the background sample value. The approach for
685 determining if a release has occurred is consistent with the EPA’s Hazard Ranking System (40
686 CFR Part 300: Appendix A): “The minimum standard to establish an observed release by
687 chemical analysis is analytical evidence of a hazardous substance in the media significantly
688 above the background level.” Table 2-3, “Observed Release Criteria for Chemical Analysis” in
689 the above referenced regulation has the following criteria:

- 690 1. If the sample measurement is less than or equal to the sample quantitation limit, no
691 observed release is established.
- 692 2. If the sample measurement is greater than or equal to the sample quantitation limit,
693 then an observed release is established as follows:
- 694 • If the background concentration is not detected (or is less than the detection limit),
695 an observed release is established when the sample measurement equals or exceeds
696 the sample quantitation limit.
 - 697 • If the background concentration equals or exceeds the detection limit, an observed
698 release is established when the sample measurement is three times or more above
699 the background concentration.

700 In the discussions that follow in Sections 4 through 9, these criteria are used to determine
701 whether a release of MC has occurred in sediment and groundwater regardless of whether the
702 analyte is considered a hazardous substance. However, these criteria are not applied for soils
703 because a statistically based determination of background has been established, and an
704 exceedance of the 95th UTL or 95th percentile, depending on the individual analyte, is used to
705 establish a release of MC.

706 ***3.6.2 Human Health Screening***

707 Human health screening values for soil and sediment analytical results were established using the
708 EPA Region 9 Preliminary Remediation Goals for Residential Soil. Table 3-3 lists the human
709 health screening values that were agreed to during the TPP process. Selection of screening levels
710 is shown in the TPP Memo (Shaw, 2006b) included as Appendix B in this SI Report.

711 ***3.6.3 Ecological Screening***

712 According to the *Screening-Level Ecological Risk Assessment (SLERA) Guidance for FUDS*
713 *MMRP Site Inspections* (USACE, 2006), only sites that are considered to be IEP or are to be
714 managed for ecological purposes, require a SLERA. As shown in Table 2-2, the Boardman AFR
715 does meet some of the 33 criteria for designation as an IEP. Table 3-4 lists the ecological
716 screening values that were agreed to during the TPP process. Shaw developed a SLERA
717 (Appendix L) using ecological screening values obtained from ODEQ (2001) and other
718 appropriate sources as described in the TPP Memo (Shaw, 2006b) included as Appendix B in
719 this SI Report.

720 ***3.7 Variances from the SSWP***

721 There were no variances to the SSWP (Shaw, 2007).

722 ***3.8 Second TPP Meeting***

723 A second TPP meeting is planned after the draft final SI Report is issued to present the SI
724 findings to stakeholders and reach consensus regarding conclusions.

725 4.0 Target No. 1

726 4.1 History and Land Use

727 The Target No. 1 AOC consists of a single target configured with concentric circles with radii of
728 100, 200, and 300 ft, which was standard range layout for the time of use. The target name is
729 consistent with the ASR Supplement. The southern one-third of the AOC overlaps with Carty
730 Reservoir Target AOC. The location of the AOC is shown on Figures 3-1 and 4-1.

731 The Target No. 1 AOC is located on BAIC, Inc. and PGE property adjacent to Carty Reservoir.
732 Approximately 40 percent of the target drop area safety zone is flooded by Carty Reservoir. The
733 safety zone is an area surrounding a target where the potential for bomb impacts exists.

734 The terrain is flat with a gradual slope toward the shoreline of Carty Reservoir. The area
735 northeast of the safety zone has been extensively reworked during power plant construction and
736 the building of an earthen dam for Carty Reservoir. The property to the north and west of the
737 target is now used for irrigated farming. Portions of land near Carty Reservoir are uncultivated
738 and near the reservoir shore, brush and trees have grown.

739 One groundwater monitoring well installed by the PGE Power Generating Station is located
740 within the AOC. An industrial water supply well is located approximately 650 ft northeast of the
741 outer boundary of the AOC. Carty Reservoir is the nearest surface water body to the AOC.
742 Sixmile Canyon Creek flows through the northeast corner of the target. The source of water for
743 Carty Reservoir is via pump from the Columbia River. The reservoir water is used for cooling at
744 the PGE Power Generating Station. Future land use is expected to remain the same.

745 The target was used between 1948 and 1960 and is thought to be a replacement target for the
746 Carty Reservoir Target, which was used between 1942 and 1945. It is unclear of the extent of
747 use of this target. During the ASR field visit, no MEC or MD were identified within the target
748 footprint or safety zone. The contractor that conducted the INPR for the USACE identified
749 several small items and according to the ASR, “the description matched that of a 31-lb practice
750 bomb.” This MD is thought to be from a MK-76 25-lb practice bomb. During the SI field
751 activities MD was identified within the footprint of Target No. 1.

752 4.2 Previous Investigations

753 Other than the ASR and INPR, no previous investigations have been completed at Target No. 1.
754 The PA/SI completed by Weston Solutions, Inc for the EPA in 2004 did not investigate this
755 AOC. However, the PA/SI collected a surface water sample from Carty Reservoir. The
756 analytical results from this sample are discussed in Section 4.4.2.

757 **4.3 MEC Evaluation**

758 The ASR Supplement identified the likely range munitions used at this AOC as being AN-Mk 5,
759 AN-Mk 23, and AN-Mk 43 practice bombs. These practice bombs contained a black powder
760 spotting charges which are relatively insensitive explosive components.

761 No MEC or MD were identified during the ASR site visit in 1997. However, the contractor that
762 conducted the INPR for the USACE identified several small items and according to the ASR,
763 “the description matched that of a 31-lb practice bomb.” This MD is thought to be from a
764 MK-76 25-lb practice bomb.

765 **4.3.1 Field Observations and Historical Evidence of MEC**

766 A visual reconnaissance of Target No. 1 was conducted prior to collection of samples to identify
767 evidence of former range activities (e.g., surface debris, or stressed vegetation). The visual
768 reconnaissance was supplemented with a Fisher all-metal detector in order to identify any
769 metallic items that may be present. The Fisher all-metal detector was used due to the high iron
770 content in the bedrock. The path walked during the visual reconnaissance was recorded using a
771 hand-held Global Positioning System (GPS) unit (Figure 4-1). During the reconnaissance, MD
772 likely from a M38A2 practice bomb was identified. No other evidence of military activity was
773 observed.

774 **4.3.2 MEC Risk Assessment**

775 The following section presents a qualitative assessment of the risk associated with potential
776 MEC at the Target No. 1 AOC. This assessment is based on historical documentation, prior
777 investigation, and visual inspection conducted during this SI. A MEC assessment is provided to
778 convey relative risk on a scale from low to high and is not intended to be a thorough risk
779 assessment as would be conducted for an RI/FS.

780 Shaw completed an all-metal detector assisted visual reconnaissance of the Target No. 1 AOC
781 the week of February 26, 2007. During the reconnaissance MD likely from a M38A2 practice
782 bomb was identified. No other MD was identified. Figure 4-1 shows the reconnaissance
783 pathways for this AOC.

784 Access to portions of Target No. 1 is restricted by locked gates and fences. Access is allowed
785 only with an escort from PGE management. Other portions of the AOC are used for irrigated
786 agriculture and access is not controlled.

787 MEC has not been reported historically at Target No. 1. MD was reported in the INPR and
788 observed during the SI field reconnaissance. The ASR nor the PA/SI (Weston, 2004) did not
789 identify any MEC or MD from this AOC. The MEC risk for this area is considered to be low
790 based on the following:

- 791 • Only MD has been reported for this AOC;
- 792 • The reported munitions used at this AOC are practice munitions only;
- 793 • The munitions used at this target used relatively insensitive explosive components;
- 794 • The area is used for farming, undergoing yearly tillage to depths of approximately 18
- 795 inches without MEC discovery;
- 796 • The unfenced area is not frequented by the public and only farm workers or PGE workers
- 797 have access to the area; and
- 798 • No MEC has ever been reported or found.

799 **4.4 Munitions Constituents Evaluation**

800 Potential MC include metals associated with steel, sheet metal, paint, and other components of
801 munitions (chromium, copper, iron, lead, molybdenum, and nickel), and black powder
802 (potassium nitrate, sulfur, and charcoal).

803 **4.4.1 Terrestrial Pathway**

804 Terrestrial receptors may be exposed to MC because soil may have been directly affected by the
805 corrosion of metals from the bomb bodies or explosives used. One surface soil sample (NWO-
806 030-0001) was proposed and collected at Target No. 1. The location was near the center of the
807 former target. The sample location is shown in Figure 4-2. The samples were analyzed for
808 select metals (chromium, copper, iron, lead, molybdenum, and nickel) by EPA Method 6020. In
809 addition, samples were analyzed for aluminum and manganese for potential use in evaluating
810 naturally occurring concentrations of metals in soil using the method of Myers and Thorbjornsen
811 (2004). The sample was also analyzed for explosives including nitroglycerin by EPA Method
812 8330A. The explosives were added at the request of the ODEQ to confirm than no explosives
813 were present.

814 Detected soil analytical results and comparison to soil background and human health and
815 ecological screening values are shown in Table 4-1. The results of the comparison to soil
816 background and human health and ecological screening values are shown pictorially on Figures
817 4-2 (metals) and 4-3 (explosives).

818 **4.4.1.1 Comparison to Background Data**

819 The analytical results were compared to the Boardman AFR site specific background values.
820 There were no background exceedances for metals and no detections of explosives.

821 **4.4.1.2 Comparison to Human Health Screening Values**

822 Soil analytical results are only compared to human health screening values if background
823 concentrations are exceeded. Because there were no exceedances of background concentrations,
824 no comparison is completed.

825 *4.4.1.3 Comparison to Ecological Screening Values*

826 Soil analytical results are only compared to ecological screening values if background
827 concentrations are exceeded. Because there were no exceedances of background concentrations,
828 no comparison is completed.

829 *4.4.2 Surface Water Pathway*

830 The surface water pathway at Boardman AFR is evaluated through surface water and sediments.
831 The potential receptors for surface water and sediments are agricultural and PGE workers and
832 wildlife. One surface water sample (SW-CR001) was collected from Carty Reservoir during the
833 PA/SI (Weston, 2004) and analyzed for perchlorate using EPA method CLP-SOW 314.0 (EPA,
834 2000). Perchlorate was not detected in the PA/SI surface water sample. The detection limit was
835 1 µg/L. A sediment sample was proposed and collected for the SI as part of the adjacent Carty
836 Reservoir Bombing Target evaluation (see Section 6.4.2)

837 *4.4.3 Groundwater Pathway*

838 The groundwater pathway at Boardman AFR was considered during the TPP discussions.
839 Groundwater was sampled during the PA/SI and analyzed for explosives and perchlorate.
840 Analysis for metals in groundwater was not included in the PA/SI. Metals analyses are available
841 for some of the nearby monitoring wells by used by PGE.

842 Two groundwater monitoring wells owned by PGE (“008” and “120”) in the vicinity of Target
843 No. 1 were sampled and analyzed for perchlorate and explosives in the PA/SI. These same two
844 wells are also sampled annually for metals by PGE. Both wells are completed in the upper most
845 water bearing zone at the top of the Columbia River Basalt. The depth to water in well “008 is
846 approximately 23 ft below ground surface (bgs) and in well “120” approximately 46 ft bgs. Note
847 that the PA/SI identifies well “008” as GW-MW024 and well “120” as GW-MW025. Well
848 “008” is located within the Target No. 1 AOC (Figure 4-4), north of the Carty Reservoir earthen
849 dam. The second well “120” is located southeast and upgradient of well “008” and Target No. 1
850 (see Figure 3-2). The most recent metals data are from 2005. Data are only available for
851 chromium, copper, iron, mercury, and lead. Molybdenum and nickel are not included in the
852 annual PGE groundwater monitoring analytical suite. Table 4-2 compares downgradient well
853 “008” to well “120” (background) and to groundwater human health screening criteria.

854 *4.4.3.1 Comparison to Background*

855 Comparison of metals analytical results from well “008” to the local background (well “120”)
856 from 2005, indicates that the iron concentration from well “008” of 50 µg/L exceeded the three
857 times background criteria of less than 10 µg/L. This indicates that a significant exceedance of
858 background has occurred. Note that PGE does not monitor for molybdenum and nickel and no
859 evaluation of these two analytes of concern can be completed.

860 During the PA/SI, groundwater samples were collected in the vicinity of Target No. 1 (wells 008
861 and 120) and analyzed for explosives and perchlorate. No explosive compounds were detected.
862 Perchlorate was detected in the local upgradient well “120” at a concentration of 3.56 µg/L.
863 Perchlorate was not detected in the downgradient well “008”.

864 *4.4.3.2 Comparison to Human Health Screening Values*

865 Comparison to human health screening levels is only completed for those analytes that
866 significantly exceed the background concentration. Iron was the only metal to be significantly
867 detected (greater than three times background) above background at a concentration of 50 µg/L.
868 This concentration is below the human health screening value of 11,000 µg/L.

869 *4.4.4 Air Pathway*

870 Air is considered to be a potential pathway due to inhalation of MC in from blowing dust. The
871 potential inhalation of soil particles is included in the development of health-based screening
872 values for soil.

873 5.0 Target No. 2

874 5.1 History and Land Use

875 The Target No. 2 AOC consists of a single target configured with concentric circles in 200- and
876 400-yard radii. In addition, there were three scoring towers 120 degrees apart near the target.
877 This range was previously assessed during the PA/SI (Weston, 2004). The target name is
878 consistent with the ASR Supplement. Figure 3-1 shows the general location of the Target No. 2
879 and Figure 5-1 shows the location with respect to the current land use in the vicinity of the target.
880 Figure 5-2 is a historical aerial photograph showing the concentric circles of the target center.
881 Note that the AOC boundary, obtained from the ASR Supplement (USACE, 2004 and the 2006
882 ARC (DoD, 2006) is not centered on the target center.

883 The Target No. 2 AOC is located on agricultural property owned by Three-mile Canyon Farms.
884 The area is currently used for irrigated farming. No groundwater wells are located within the
885 boundary of Target No 2 AOC. The nearest surface water is Sixmile Canyon Creek located
886 approximately 1,800 ft west of the southwest boundary of the AOC. The future land use is not
887 expected to change from the present use. The target was used between 1942 and 1960 for
888 practice bombing.

889 5.2 Previous Investigations

890 The ASR evaluated Target Area No. 2. The team encountered MD up to 325 yards from the
891 target center. Items observed by the ASR team included M38A2 practice bombs, AN-M52 and
892 AN-M50A2 incendiary bombs, and Mk 6 2.25-inch practice rockets.

893 The PA/SI collected two surface soil samples (0 to 0.5 ft bgs) and two subsurface soil samples
894 (0.5 to 2.0 ft bgs) from a location north of the target area (Figure 5-2). Samples were analyzed
895 for metals and perchlorate.

896 5.3 MEC Evaluation

897 Likely range munitions used at this AOC are listed as AN-M50 incendiary bombs, M38A2
898 practice bombs and Mk 6 2.25-inch practice rockets. Recent MEC finds at Target No. 2 included
899 AN-M57 GP practice bomb. MD from AN-47, and Mk-15 Mod 3 100 lb practice bombs has
900 also been reported (Weston, 2004). The AN-M50 and AN-M52 incendiary bombs were cased in
901 a magnesium shell and contained a fuze and thermite. Thermite consists of a mixture of
902 powdered aluminum metal and ferric oxide. The M38A2 practice bombs were a sand-filled,
903 sheet metal cased, 100-lb practice bomb and contained a black powder spotting charge. The Mk
904 6 2.25-inch practice rockets were constructed from sheet metal. The propellant used in the
905 rocket was ballistite, which consists of nitrocellulose and nitroglycerin. There were no spotting
906 charges in the Mk 6 rockets. The use of the Mk 6 practice rocket is thought to be limited at this

907 target as evidenced by the scarcity of spent rocket motors. The reported AN-M57 GP practice
908 bombs contained a spotting charge only. The AN-47 practice bombs were reported in the PA/SI
909 (Weston, 2004) and may have been sand filled or were smoke or incendiary munitions. All of
910 the above munitions contained relatively insensitive explosive components, except the AN-M47
911 which may have contained a sensitive fuze.

912 *5.3.1 Field Observations and Historical Evidence of MEC*

913 The types of munitions used at the Target No. 2 AOC are listed above. Debris from these
914 munitions was observed during the ASR site visit in 1997, during the 2004 PA/SI investigation,
915 and in 2006 during a Navy EOD recovery. The ASR indicated that four 75-mm HEAT M66
916 projectiles were reported to have been destroyed in the target area by Army EOD in 1987. The
917 ASR indicated that the 75-mm projectiles were likely brought to the AOC for disposal and not
918 used at the site. MEC was reported from this AOC as recently as March 2006.

919 No field reconnaissance was conducted at this AOC during the SI because MEC and MD were
920 reported as recently as March 2006. However, prior to collecting soil samples, the path from the
921 vehicle to the sampling point was visually surveyed and the path recorded using a GPS unit by a
922 UXO technician with the aid of an all-metal detector. No MEC or MD was noted during
923 sampling activities. The path is shown on Figure 5-1.

924 *5.3.2 MEC Risk Assessment*

925 The following section presents a qualitative assessment of the risk associated with potential
926 MEC, as based on historical documentation, prior investigation, and visual inspection conducted
927 during this SI. A MEC assessment is provided to convey relative risk on a scale from low to
928 high and is not intended to be a thorough risk assessment as would be conducted for an RI/FS.

929 Access to Target No. 2 is unrestricted. The area is used for irrigated agriculture and physical
930 barriers are not present.

931 MEC has been reported historically at Target No. 2 as recently as March 2006. The MEC risk
932 for this area is considered to be moderate based on the following:

- 933 • MEC has been reported as recently as March 2006, recent finds were AN-M57 GP
934 practice bombs;
- 935 • All munitions contained relatively insensitive explosive components except for the
936 AN-M47 which may have had a sensitive fuze;
- 937 • The area is used for farming, undergoing yearly tillage to depths of approximately 18
938 inches and MEC and MD is periodically unearthed;

- 939 • The unfenced area is frequented by farm workers; the general public does not have
940 routine access to the AOC.

941 **5.4 Munitions Constituents Evaluation**

942 Potential MC include metals associated with steel, sheet metal, paint, and other components of
943 munitions (chromium, copper, iron, lead, molybdenum, and nickel), black powder (potassium
944 nitrate, sulfur, and charcoal), thermite (powdered aluminum and ferric oxide), ballistite
945 (nitrocellulose and nitroglycerine), and Amatol (ammonium nitrate and TNT), and tetryl.

946 **5.4.1 Terrestrial Pathway**

947 Terrestrial receptors may be exposed to MC because soil may have been directly affected by the
948 corrosion of metals from the bomb bodies or explosives used. Two surface soil samples (NWO-
949 030-0002 and NWO-030-0003) were proposed and collected at Target No. 2. The sample
950 locations are shown on Figures 5-2 and 5-3. The samples were analyzed for select metals
951 (aluminum, chromium, copper, iron, lead, molybdenum, and nickel) by EPA Method 6020A. In
952 addition, samples were analyzed for aluminum and manganese for potential use in evaluating
953 naturally occurring concentrations of metals in soil using the method of Myers and Thorbjornsen
954 (2004). The samples were also analyzed for explosives including nitroglycerin by EPA Method
955 8330A.

956 Two surface soil samples (0 to 0.5 ft bgs) (SS-PS003 and SS-PS005) and two subsurface soil
957 samples (0.5 to 2.0 ft bgs) (SB-PS003 and SB-PS005) were collected during the PA/SI (Weston,
958 2004). Samples were analyzed for TAL metals using *Contract Laboratory Program (CLP)*
959 *Statement of Work (SOW) for Inorganics Analysis ILM05.3* (EPA, 2004) and perchlorate using
960 EPA Method 314.0 (EPA, 2000) (Table 2-3). The PA/SI sample locations were located north of
961 the Target No. 2 AOC boundary, but are included in this evaluation for completeness.

962 **5.4.1.1 Comparison to Background Data**

963 The detected metals concentrations in soil for both the SI samples and the PA/SI samples are
964 listed on Table 5-1. There were no exceedances of the SI background soil concentrations in any
965 sample. There were no explosive or perchlorate detections in either the SI or PA/SI samples.

966 **5.4.1.2 Comparison to Human Health Screening Values**

967 Soil analytical results are only compared to human health screening values if background
968 concentrations are exceeded. Because there were no exceedances of background concentrations,
969 no comparison is completed.

970 **5.4.1.3 Comparison to Ecological Screening Values**

971 Soil analytical results are only compared to ecological screening values if background
972 concentrations are exceeded. Because there were no exceedances of background concentrations,
973 no comparison is completed.

974 **5.4.2 Surface Water Pathway**

975 As agreed to during the TPP process, no surface water or sediment samples were identified to be
976 collected in the vicinity of the Target No. 2. Five surface water samples and one sediment
977 sample were collected from the Sixmile Canyon Creek drainage during the PA/SI at locations
978 greater than one mile from the center of the AOC. The locations of the surface water samples
979 are shown on Figure 5-4. The surface water samples were analyzed for perchlorate using EPA
980 Method 314.0 (EPA, 2000) and one sample was also analyzed for perchlorate using EPA SW-
981 846 Method 8321-modified (STL, 2004). The sediment sample was analyzed for TAL metals
982 using EPA method CLP SOW ILM05.3 (EPA, 2004). The potential receptors for MC in surface
983 water and sediments are agricultural and PGE workers and wildlife.

984 Detected sediment analytical results and comparison to background and human health and
985 ecological screening values are provided on Table 5-2. The surface water perchlorate analytical
986 results are shown on Figure 5-4.

987 **5.4.2.1 Comparison to Background Data**

988 A background surface water sample was not collected for the PA/SI. Perchlorate was detected in
989 all five surface water samples at concentrations ranging from 0.32 µg/L to 7.49 µg/L. The
990 highest surface water concentration was detected in the sample (SW-SC006) collected the
991 farthest upstream near the western boundary of the FUDS. This location (SW-SC006) is
992 approximately 1.5 miles northwest of Target No. 1 and well away from any bombing activity at
993 Boardman AFR (Figure 2-9). The lowest concentration was detected in the sample (SW-SC001)
994 collected the farthest downstream (Figure 5-4).

995 The concentrations of metals detected in the PA/SI sediment are listed on Table 5-2. There were
996 no significant exceedances (greater than three times the background concentration) of the SI
997 background sediment soil concentration in the sample.

998 **5.4.2.2 Comparison to Human Health Screening Values**

999 The maximum detected concentration of perchlorate was 7.49 µg/L which is below the DoD
1000 action level of 24 µg/L.

1001 The sediment sample analytical results are only compared to human health screening values if
1002 background concentrations are significantly exceeded. Because there were no significant
1003 exceedances of background concentrations, no comparison is completed.

1004 **5.4.2.3 Comparison to Ecological Screening Values**

1005 There is no surface water ecological screening value for perchlorate and no comparison can be
1006 made. Sediment analytical results are only compared to ecological screening values if
1007 background concentrations are significantly exceeded. Because there were no significant
1008 exceedances of background concentrations, no comparison is completed.

1009 **5.4.3 Groundwater Pathway**

1010 As agreed to in the TPP Memo (Shaw, 2006b), no groundwater samples were collected from
1011 Target No. 2 as part of the SI field activities. Groundwater samples were collected from within
1012 the Boardman AFR FUDS and surrounding property during the PA/SI (see Section 2.5.3).

1013 **5.5 Air Pathway**

1014 Air is considered to be a potential pathway due to inhalation of MC in blowing dust. The
1015 potential inhalation of soil particles is included in the development of health-based screening
1016 values for soil.

1017 **6.0 Carty Reservoir Bomb Target**

1018 **6.1 History and Land Use**

1019 The Carty Reservoir Bomb Target AOC consists of a single target configured with concentric
1020 circles (spacing not identified). This target is located on the western side of Carty Reservoir
1021 (Figure 4-1). Prior to the ASR, this target was not identified in any historical documents. It is
1022 thought that this target was the original target at the range. The ASR team believed that the
1023 original Target No. 1 was located in this area and then was relocated approximately 1 mile north
1024 in approximately 1946. The target is thought to have been used between 1942 and 1945 for
1025 practice bombing; however, the actual date of use is not known.

1026 The Carty Reservoir Bomb Target was located in a depression which made scoring difficult. The
1027 new Target No. 1 location (discussed in Section 4.0) is much flatter and at a higher elevation.
1028 The target name is consistent with the ASR Supplement. Figure 3-1 shows the general location
1029 of Carty Reservoir Bomb Target AOC. Figure 4-1 shows a more detailed view of the AOC.
1030 Figure 4-2 is a photograph from 1965 and the concentric target circles can be observed. This
1031 AOC overlaps Target No. 1 AOC.

1032 The Carty Reservoir Bomb Target AOC is located on PGE and BAIC, Inc (leased by Three-mile
1033 Canyon Farms) property. The western half of the AOC is currently used for irrigated farming
1034 and the southern and eastern portion is native vegetation consisting of grasses and small trees are
1035 present along the shoreline of Carty Reservoir. There is evidence of historical livestock grazing
1036 in the area. The terrain slopes toward Carty Reservoir. No groundwater wells are located within
1037 the boundary of this AOC. Carty Reservoir covers approximately 30 percent of the area.

1038 **6.2 Previous Investigations**

1039 The ASR team visited the Carty Reservoir Bomb Target and identified live practice bombs near
1040 the target center. The Army EOD was notified by PGE and disposed of five suspected live
1041 practice bombs (ASR, Appendix M2). MEC and MD identified by the ASR team included Mk-
1042 23, M38A2 practice bombs, and M75 and M84 target marker bombs.

1043 One surface water sample was collected from Carty Reservoir during the PA/SI and analyzed for
1044 perchlorate. Note that the water for Carty Reservoir is pumped from the Columbia River.

1045 **6.3 MEC Evaluation**

1046 Likely range munitions used at this AOC was the Mk 23, and M38A2 practice bombs and the
1047 M75 and M84 target marker bomb. The Mk 23 practice bombs were constructed from cast iron
1048 and contained black powder and a red phosphorus pyrotechnic signal charge. The M38A2
1049 practice bombs were a sand-filled sheet metal cased 100-lb practice bomb and contained a black
1050 powder spotting charge. The M75 and M84 target marker bombs were cased in sheet metal and

1051 contained a burster and fuze and a charge of red iron ore (hematite) that was used as a marker.
1052 The M75/M84 target marker bombs contained sensitive fuzing.
1053 Large amounts of debris from these munitions were observed during the ASR site visit in 1997.
1054 This AOC was the only area where the ASR team observed relatively intact, fuzed, and
1055 suspected live munitions (M75/M84 practice bomb) during the 1997 site visit.

1056 ***6.3.1 Field Observations and Historical Evidence of MEC***

1057 As agreed to at the TPP meeting, no visual reconnaissance was completed at the Carty Reservoir
1058 Bomb Target, because sufficient historical evidence of MEC and munitions debris present at this
1059 AOC. A visual reconnaissance was completed at Target No. 1 located immediately north. The
1060 northern portion of the Carty Reservoir Bomb Target safety circle overlaps the reconnaissance
1061 route completed on Target No. 1, on a portion of property. The route is shown on Figure 4-1.

1062 ***6.3.2 MEC Risk Assessment***

1063 The following section presents a qualitative assessment of the risk associated with potential
1064 MEC, as based on historical documentation, prior investigation, and visual inspection conducted
1065 during this SI. A MEC assessment is provided to convey relative risk on a scale from low to
1066 high and is not intended to be a thorough risk assessment as would be conducted for an RI/FS.

1067 Access to portions of Carty Reservoir Bomb Target is restricted by locked gates and fences.
1068 Access is available only by escort by PGE management or The Nature Conservancy. Other
1069 portions of the AOC are used for irrigated agriculture and access is not controlled.

1070 Munitions used at Carty Reservoir Bomb Target were primarily practice rounds including AN-
1071 Mk23 and M38A2 practice bombs. The M75/M84 target identification bombs may have
1072 contained sensitive fuzing. The potential for MEC at the Carty Reservoir Bomb Target is
1073 moderate. This is based on the following:

- 1074 • MEC was reported during the ASR in 1995;
- 1075 • The M75/M84 target marker bombs may have contained sensitive fuzing;
- 1076 • The unfenced area is used for farming, undergoing yearly tillage to depths of
1077 approximately 18 inches.

1078 The area is frequented by farm workers; the general public does not have routine access to the
1079 AOC.

1080 ***6.4 Munitions Constituents Evaluation***

1081 Based on historical information and reports of MEC and MD in the ASR, munitions used at
1082 Carty Reservoir Bomb Target were practice munitions. Potential MC include metals associated
1083 with sheet metal, cast iron, paint, and other components of munitions (iron and lead).

1084 Chromium, copper, molybdenum and nickel were included as potential metal MC during the
1085 TPP planning, although no identified source is known at the Carty Reservoir AOC. The only
1086 explosive documented as being used was black powder.

1087 *6.4.1 Terrestrial Pathway*

1088 Terrestrial receptors may be exposed to MC because soil may have been directly affected by the
1089 corrosion of metals from the bomb bodies or explosives used. Two surface soil samples (NWO-
1090 030-0004 and NWO-030-0005) were proposed and collected at Carty Reservoir Bomb Target.
1091 The samples were analyzed for select metals (chromium, copper, iron, lead, molybdenum, and
1092 nickel) by EPA Method 6020A. Chromium, copper, molybdenum and nickel were included in
1093 the analytical suite for this AOC to be consistent with other AOCs at Boardman AFR. In
1094 addition, samples were analyzed for aluminum and manganese for potential use in evaluating
1095 naturally occurring concentrations of metals in soil using the method of Myers and Thorbjornsen
1096 (2004). One sample NWO-030-0005 was also analyzed for explosives including nitroglycerin
1097 by EPA Method 8330A. The explosives were added at the request of the ODEQ to confirm that
1098 no explosives were present. The sample locations and results are shown in Figures 4-2 and 4-3.
1099 No soil samples were collected from this AOC during the PA/SI.

1100 *6.4.1.1 Comparison to Background Data*

1101 The detected metals concentrations in soil are listed on Table 6-1. There were no exceedances of
1102 the SI background soil concentrations in any sample. There were no explosives detected in the
1103 one sample analyzed for explosives.

1104 *6.4.1.2 Comparison to Human Health Screening Values*

1105 Soil analytical results are only compared to human health screening values if background
1106 concentrations are exceeded. Because there were no exceedances of background concentrations,
1107 no comparison is completed.

1108 *6.4.1.3 Comparison to Ecological Screening Values*

1109 Soil analytical results are only compared to ecological screening values if background
1110 concentrations are exceeded. Because there were no exceedances of background concentrations,
1111 no comparison is completed.

1112 *6.4.2 Surface Water Pathway*

1113 Primary exposure to surface water is through direct contact of PGE workers and wildlife. One
1114 surface water sample was collected from Carty Reservoir during the PA/SI (SW-CR001) and
1115 analyzed for perchlorate using EPA method CLP-SOW 314.0 (EPA, 2000). One sediment
1116 sample (NWO-030-1001) and field duplicate (NWO-030-1003) were collected from the shore of
1117 Carty Reservoir (Figure 4-2). The samples were analyzed for select metals using EPA SW-846
1118 Method 6020A, and explosives including nitroglycerin using EPA SW-846 Method 8330A.

1119 **6.4.2.1 Comparison to Background Data**

1120 The detected metals concentrations in sediment are listed on Table 6-2. There were no
1121 significant exceedances of the SI background sediment concentrations in any sample. There
1122 were no explosive detections in the sediment samples. Perchlorate was not detected in the PA/SI
1123 surface water sample (detection limit 1 µg/L).

1124 **6.4.2.2 Comparison to Human Health Screening Values**

1125 Sediment and surface water analytical results are only compared to human health screening
1126 values if background concentrations are exceeded. Because there were no exceedances of
1127 background concentrations, no comparison is completed.

1128 **6.4.2.3 Comparison to Ecological Screening Values**

1129 Sediment and surface water analytical results are only compared to ecological screening values if
1130 background concentrations are exceeded. Because there were no exceedances of background
1131 concentrations, no comparison is completed.

1132 **6.4.3 Groundwater Pathway**

1133 As agreed to in the TPP Memo (Shaw, 2006b), no groundwater samples were collected from
1134 Carty Reservoir Bomb Target as part of the SI field activities. Groundwater samples were
1135 collected from within the Boardman AFR FUDS and surrounding property (see Section 2.5.3)
1136 during the PA/SI.

1137 **6.4.4 Air Pathway**

1138 Air is considered to be a potential pathway due to inhalation of MC in from blowing dust. The
1139 potential inhalation of soil particles is included in the development of health-based screening
1140 values for soil.

1141 *7.0 Range Complex No. 1*

1142 *7.1 History and Land Use*

1143 The Range Complex No. 1 AOC consists of three areas: INPR Site No. 1, the Demolition Area,
1144 and the Turret Gunnery Training Range. Figure 3-1 shows the general location of the Range No.
1145 1 Complex AOC. Figure 7-1 shows a general overview of the AOC.

1146 The INPR Site No. 1 is a bomb target that was in use between 1946 and 1960. The ASR
1147 Supplement indicated that the target was configured with concentric circles of 100, 200, and 300
1148 ft. However, analysis of historical aerial photos (1965) shows faint concentric circles at 75, 500,
1149 and 1000 ft (Figures 7-2 and 7-3). A portion of the safety zone for INPR Site No. 1 lies within
1150 the non-FUDS property currently used by the Navy Bombing Range. Soil samples were
1151 collected from INPR Site No.1 during the PA/SI.

1152 The Demolition Area was used for the demolition of munitions between 1952 and 1960 and may
1153 be the area used by the Umatilla Ordnance Depot for demolition of unserviceable munitions.
1154 The area consists of two rows, approximately 200 ft apart (Figures 7-4, 7-5 and 7-6). Each row
1155 has approximately 20 pits (craters) spaced approximately 50 ft apart. MD was reported as
1156 embedded in the crater walls and scattered in a wide radius from the craters (ASR, 1997), and
1157 MD was found during the 2007 field activities.

1158 The Turret Gunnery Training Range was used to train B-36 Bomber gunners to fire at target
1159 drones that flew across their front. The turret gun firing points were located on current Navy
1160 Bombing Range Property and are not FUDS property. Only the downrange portion of the range
1161 is within the Boardman AFR FUDS. A portion of the safety zone is outside of the FUDS
1162 boundary on the active Navy bombing range. The range name is consistent with the ASR
1163 Supplement.

1164 Much of the northern and eastern portions of Range Complex No.1 are currently being used for
1165 irrigated crops (Figure 7-1). The southern portion of the range is used for the Boeing Antennae
1166 Test Range, and wildlife conservation area managed by The Nature Conservancy. No
1167 groundwater wells are located within the boundary of this AOC. Future land use is expected to
1168 remain the same as current land use.

1169 *7.2 Previous Investigations*

1170 The ASR visited the Range Complex No. 1 area. The area of INPR Site No. 1 was reported to be
1171 “littered with bomb bodies in sizes ranging from the 3 lb Mk 23 up to the 2,000 lb BDU-10”
1172 (ASR, page 21). In addition, the ASR reported finding “pieces of heavy metal fragments from
1173 high explosive ordnance” (ASR, page 21).

1174 The Demolition Area was also visited by the ASR team which reported finding two rows of
1175 demolition craters, each row consisting of approximately twenty craters. The craters were used
1176 for demolition of munitions. MD was reported within and surrounding the craters. The ASR
1177 team performed a random inspection of the Turret Gunnery Training Range safety fan and did
1178 not find any MD.

1179 The PA/SI collected two surface soil samples (0 to 0.5 ft bgs) and two subsurface soil samples
1180 (0.5 to 2.0 ft) from within INPR Site No. 1 and shown on Figures 7-2 and 7-3. Samples were
1181 analyzed for metals, explosives and perchlorate.

1182 **7.3 MEC Evaluation**

1183 The likely range munitions used were:

- 1184 ▪ INPR Site No. 1 – Mk 23, Mk 76, Mk 84, Mk 89, Mk 106, M38A2, BDU 10, and BDU
1185 33 practice bombs. In addition Weston (2004) reported finding a Mark-12 practice
1186 nuclear bomb (inert training bomb filled with concrete) and a Fuel-Air-Explosive BLU-
1187 95 bomb. The Mark-12 and BLU-95 were likely bombs that drifted over from the
1188 adjacent Navy Bomb Range. The Mark-12 has a parachute that is deployed during
1189 descent from the aircraft. The Shaw UXO safety expert reviewed the photograph of the
1190 reported BLU-95 and identified the bomb as a BLU-73. The BLU-73 contains extremely
1191 sensitive explosive components. All others contain relatively insensitive explosive
1192 components.
- 1193 ▪ Demolition Area – C-4 Blocks, M60 igniter, detonation cord and time blasting fuze,
1194 blasting caps both electric and non-electric, all other munitions types used on the
1195 Boardman AFR. The detonation cord has a moderate explosive sensitivity risk.
- 1196 ▪ Turret Gunnery Training Range – 20-mm Ball practice ammunition. The projectile is
1197 machined from bar steel. The ammunition has a relatively insensitive explosive risk.

1198 The types of munitions used at the Range Complex No. 1 AOC are listed above. Debris from
1199 these munitions was observed during the ASR site visit in 1997. The ASR noted that other than
1200 the Mk 23 practice bomb, the remaining bombs on INPR Site No. 1 are post Korean War
1201 vintage, particularly the BDU-10 practice nuclear bomb.

1202 **7.3.1 Field Observations and Historical Evidence of MEC**

1203 The Demolition Area and Turret Gunnery Training Range were visited during the SI field
1204 investigation. No visual reconnaissance was completed in either area as the presence of MEC
1205 and munitions debris has been previously observed. However, prior to collecting soil samples at
1206 both areas, the path from the vehicle to the sampling point was visually surveyed by a UXO
1207 technician with the aid of an all-metal detector. The paths are shown on Figures 7-1 and 7-6.
1208 MD was observed in the Demolition Area (Figure 7-6), but no debris was observed at the
1209 sampling locations for the Turret Gunnery Training Range.

1210 The ASR identified MD in both INPR Site No. 1 and the Demolition Area. None was observed
1211 in the Turret Gunnery Training Range. The PA/SI reported observing at the INPR Site No. 1
1212 Mk-76, Mk-89, Mk-84, and Mark 12 practice bombs and a BLU-95 (BLU-75) fuel air explosive
1213 bomb.

1214 *7.3.2 MEC Risk Assessment*

1215 The following section presents a qualitative assessment of the risk associated with potential
1216 MEC, as based on historical documentation and SI field observations. A MEC assessment is
1217 provided to convey relative risk on a scale from low to high and is not intended to be a thorough
1218 risk assessment as would be conducted for an RI/FS.

1219 Access to portions of Range Complex No. 1 is restricted by the Boeing Company through locked
1220 gates and fences and access is only through security personnel. Areas with restricted access
1221 include all of the Demolition Area and portions INPR Site No. 1 and the Turret Gunnery Range.
1222 Access to the remainder of INPR Site No. 1 is through locked gates. Access to those areas used
1223 for irrigated agriculture is not restricted.

1224 The overall MEC risk for Range Complex No. 1 is moderate, with the risk concentrated at INPR
1225 Site No. 1 and the Demolition Area. This assessment is based on the following:

- 1226 • Munitions debris has been reported at INPR Site No. 1 and the Demolition area;
- 1227 • The BLU-73 that was located at INPR Site No. 1 contains extremely sensitive explosive
1228 components. Munitions was likely drift over from adjacent Navy Range;
- 1229 • Detonation cord used at the Demolition area contains sensitive explosive components;
- 1230 • A portion of the area is used for farming, undergoing yearly tillage to depths of
1231 approximately 18 inches.
- 1232 • Access to portions of INPR Site No. 1 and all of the Demolition area are controlled by
1233 security personnel. The remainder of the area of INPR Site No. 1 is controlled by locked
1234 gates. All irrigated agricultural areas are frequented by farm workers; the general public
1235 does not have routine access to the AOC.

1236 *7.4 Munitions Constituents Evaluation*

1237 Potential MC include metals associated with steel, sheet metal, paint, and other components of
1238 munitions (chromium, copper, iron, lead, mercury, molybdenum, and nickel), and explosives
1239 including nitroglycerin and pentaerythritol tetranitrate (PETN).

1240 *7.4.1 Terrestrial Pathway*

1241 Terrestrial receptors may be exposed to MC because soil may have been directly affected by the
1242 corrosion of metals from the bomb bodies or explosives used. As discussed in Section 7.2
1243 above, two surface soil samples (0 to 0.5 ft bgs) and two subsurface soil samples (0.5 to 2.0 ft
1244 bgs) were collected during the PA/SI (Figures 7-2 and 7-3). The samples were analyzed for TAL

1245 metals using EPA method CLP SOW ILM05.3 (EPA, 2004), explosives using EPA SW-846
1246 Method 8330, and perchlorate using EPA Method 314.0 (EPA, 2000) (Table 2-3).

1247 Two surface soil samples (NWO-030-0006 and NWO-030-0007) and one field duplicate (NWO-
1248 030-0013) were proposed and collected from the Demolition Area (Figures 7-4, 7-5 and 7-6).
1249 One sample location was from within a detonation crater and the second was from outside and
1250 both near locations of MD. Two soil samples (NWO-030-0008 and NWO-030-0009) were
1251 proposed and collected from the Turret Gunnery Training Range (Figure 7-7). Locations were
1252 from within the fan of the gunnery range.

1253 The four samples were analyzed for select metals (chromium, copper, iron, lead, mercury,
1254 molybdenum, and nickel) by EPA Method 6020A. In addition, samples were analyzed for
1255 aluminum and manganese for potential use in evaluating naturally occurring concentrations of
1256 metals in soil using the method of Myers and Thorbjornsen (2004). The two samples from the
1257 Demolition Area were also analyzed for explosives including nitroglycerin and PETN by EPA
1258 SW-846 Method 8330A (Table 3-1). Samples from the Turret Gunnery Training Range were not
1259 analyzed for explosives because only 20-mm ball practice rounds from ground-to-air gunnery
1260 practice were used.

1261 *7.4.1.1 Comparison to Background Data*

1262 The detected metals concentrations in soil from both SI and PA/SI sampling are listed on Tables
1263 7-1, 7-2, and 7-3. There were no metals exceedances of the background soil concentrations in
1264 any samples (Figures 7-2, 7-4 and 7-7). There were no explosives detected in the two SI samples
1265 from the Demolition Area (Figure 7-5). There were no explosives detected and no perchlorate
1266 detected in the PA/SI samples (Figure 7-3).

1267 *7.4.1.2 Comparison to Human Health Screening Values*

1268 Soil analytical results are only compared to human health screening values if background
1269 concentrations are exceeded. Because there were no exceedances of background concentrations,
1270 no comparison is completed.

1271 *7.4.1.3 Comparison to Ecological Screening Values*

1272 Soil analytical results are only compared to ecological screening values if background
1273 concentrations are exceeded. Because there were no exceedances of background concentrations,
1274 no comparison is completed.

1275 *7.4.2 Surface Water Pathway*

1276 The nearest surface water is Carty Reservoir located approximately 6 miles southwest of the
1277 center of the range complex. Because of the distance, there is no complete surface water
1278 pathway and no surface water or sediment samples were planned or collected.

1279 **7.4.3 Groundwater Pathway**

1280 The TPP Memo (Shaw 2006b) indicated that groundwater was a potentially affected media, with
1281 potential receptors located downgradient of the FUDS boundary. No groundwater drinking
1282 water wells are located within the AOC, but drinking water wells are located downgradient of the
1283 AOC. As discussed in the TPP Memo, the PA/SI addressed the groundwater pathway for the
1284 Boardman AFR, and sufficient data exist to assess groundwater. Section 2.5.3 of this SI report
1285 presents the results of the PA/SI sampling.

1286 Groundwater samples were collected within, downgradient, and cross gradient of the Boardman
1287 AFR. A total of 25 groundwater samples were collected from the area within and surrounding
1288 the Boardman AFR. Four of the samples were located on the Boardman AFR FUDS. Samples
1289 were analyzed for explosive compounds and perchlorate (see Section 2.5.3). Metals were not
1290 included in the PA/SI analytical suite; however, the metals associated with the munitions used at
1291 this AOC have a low mobility. If impacts from metals in soil were present, movement to the
1292 groundwater would not be expected. As agreed to in the TPP Memo (Shaw, 2006b), no
1293 groundwater samples were planned or collected during the SI.

1294 **7.4.3.1 Comparison to Background**

1295 As agreed in the TPP Memo (Shaw, 2006b), no groundwater samples were collected from within
1296 the Range Complex No. 1 AOC during the SI, and no groundwater samples were collected from
1297 the AOC during the PA/SI. However, as discussed in Section 2.5.3, samples were collected
1298 down and cross gradient of the AOC and FUDS. The sampling results indicated that no
1299 explosives were detected in any groundwater sample and perchlorate was detected in 18 of 25
1300 wells sampled in the PA/SI. In the 18 samples with perchlorate detections, concentrations
1301 ranged between 0.46 µg/L and 20.7 µg/L. No background value for perchlorate was established
1302 in the PA/SI. However, based on studies completed by the ODEQ and EPA (ODEQ, 2005),
1303 perchlorate is found throughout the lower Umatilla Basin in wells located up, cross and
1304 downgradient of the Boardman AFR. This indicates that the perchlorate detected in groundwater
1305 samples is not originating from sources within this AOC or the Boardman AFR FUDS.

1306 **7.4.3.2 Comparison to Human Health Screening Values**

1307 The DoD action level for perchlorate is 24 µg/L. All detected concentrations of perchlorate in
1308 the vicinity of Boardman AFR FUDS are below the DoD action level.

1309 **7.4.4 Air Pathway**

1310 Air is considered to be a potential pathway due to inhalation of MC in from blowing dust. The
1311 potential inhalation of soil particles is included in the development of health-based screening
1312 values for soil.

1313 **8.0 Demolition Area No. 2**

1314 **8.1 History and Land Use**

1315 Demolition Area No. 2 was identified during the TPP meeting. The identification was made
1316 through interviews with a property leaseholder (The Nature Conservancy) and the Oregon State
1317 Police. The AOC consists of a number of detonation craters with MD (Figure 8-1). Munitions,
1318 fuzes, and MD were recently destroyed by the Oregon State Police at this AOC.

1319 Little is known of the Demolition Area No. 2 AOC and who used it. The area appears to have
1320 been used as an ordnance disposal/demolition area. Note that the boundary for Demolition Area
1321 No. 2 is dashed because the extent of the AOC has not been verified. The dashed boundary does
1322 include extent of demolition craters observed on aerial photography. No groundwater wells are
1323 located within the boundary of this AOC. The land is currently used as a wildlife conservation
1324 area. Future land is expected to remain the same as current land use.

1325 **8.2 Previous Investigations**

1326 No previous investigations have been completed at this AOC.

1327 **8.3 MEC Evaluation**

1328 Munitions identified as having been present at the Demolition Area No. 2 include: M83 Butterfly
1329 bombs, M66 base detonator fuzes, 100-lb GP bomb base plate, C-4 blocks, detonation cord and
1330 time blasting fuze, and blasting caps (both electric and non-electric). Other munitions may have
1331 been destroyed at this site. All of the above munitions have sensitive explosive components
1332 except for the C-4 blocks.

1333 **8.3.1 Field Observations and Historical Evidence of MEC**

1334 A visual reconnaissance with the aid of an all metal detector for safety was completed as part of
1335 the SI field activities. The path of the visual reconnaissance is shown on Figure 8-1. The UXO
1336 technician reported that large accumulations of MD were observed, including heavy wall
1337 fragments. No MEC was identified.

1338 Debris from munitions was privately located by employees of The Nature Conservancy who
1339 manage a portion of land for critical wildlife habitat and Oregon State Police EOD unit. In June
1340 2006 Ordnance disposal of an M83 Butterfly bomb was completed by the Oregon State Police.

1341 **8.3.2 MEC Risk Assessment**

1342 The following section presents a qualitative assessment of the risk associated with potential
1343 MEC, as based on historical documentation and SI field work. A MEC assessment is provided to
1344 convey relative risk on a scale from low to high and is not intended to be a thorough risk
1345 assessment as would be conducted for an RI/FS.

1346 Access to Demolition Area No. 2 is restricted by locked gates and fences. Access is available
1347 through The Nature Conservancy.

1348 The MEC risk for Demolition Area No. 2 is moderate. This assessment is based on:

- 1349 ▪ Recent find and demolition of a M83 butterfly bomb by Oregon State Police EOD Unit;
- 1350 ▪ Observed accumulations of MD;
- 1351 ▪ Sensitive fuzes contained in reported MEC and MD;
- 1352 ▪ Access through locked gates but unpatrolled.

1353 ***8.4 Munitions Constituents Evaluation***

1354 Potential MC include metals associated with steel, sheet metal, paint, and other components of
1355 munitions (chromium, copper, iron, lead, mercury, molybdenum, and nickel) and explosives
1356 (TNT, tetryl, hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX], and PETN)

1357 ***8.4.1 Terrestrial Pathway***

1358 Terrestrial receptors may be exposed to MC because soil may have been directly affected the
1359 corrosion of metals from the bomb bodies or explosives used. Two surface soil samples (NWO-
1360 030-0010 and NWO-030-0011) were proposed and collected from the Demolition Area No. 2.
1361 The sample locations are shown on Figures 8-2 and 8-3. The samples were analyzed for select
1362 metals (chromium, copper, iron, lead, mercury, molybdenum, and nickel) by EPA Method
1363 6020A. In addition, samples were analyzed for aluminum and manganese for potential use in
1364 evaluating naturally occurring concentrations of metals in soil using the method of Myers and
1365 Thorbjornsen (2004). The soil sample was also analyzed for explosives including nitroglycerin
1366 and PETN by EPA SW-846 Method 8330A (Table 3-1).

1367 ***8.4.1.1 Comparison to Background Data***

1368 Detected metals were compared to background soil concentrations (Table 8-1). There were no
1369 exceedances of background soil concentrations. There were no detections of explosives in either
1370 sample.

1371 ***8.4.1.2 Comparison to Human Health Screening Values***

1372 Soil analytical results are only compared to human health screening values if background
1373 concentrations are exceeded. Because there were no exceedances of background concentrations,
1374 no comparison is completed.

1375 ***8.4.1.3 Comparison to Ecological Screening Values***

1376 Soil analytical results are only compared to ecological screening values if background
1377 concentrations are exceeded. Because there were no exceedances of background concentrations,
1378 no comparison is completed.

1379 **8.4.2 Surface Water Pathway**

1380 The nearest surface water is Carty Reservoir, located approximately 4 miles to the southwest.
1381 Because of this distance, there is no complete surface water pathway. No surface water or
1382 sediment samples were planned or collected from the Demolition Area No. 2.

1383 **8.4.3 Groundwater Pathway**

1384 The TPP Memo (Shaw, 2006b) indicated that groundwater was a potentially affected media, with
1385 potential receptors located downgradient of the FUDS boundary. No groundwater drinking
1386 water wells are located within the AOC, but drinking water wells are located downgradient of the
1387 Demolition Area No. 2 AOC. As discussed in the TPP Memo, the PA/SI addressed the
1388 groundwater pathway for the Boardman AFR, and sufficient data exist to assess groundwater.
1389 Section 2.5.3 of this SI report presents the results of the PA/SI sampling.

1390 Groundwater samples were collected within, downgradient, and cross gradient of the Boardman
1391 AFR. A total of 25 groundwater samples were collected from the area within and surrounding
1392 the Boardman AFR. Four of the samples were located on the Boardman AFR FUDS. Samples
1393 were analyzed for explosive compounds and perchlorate (see Section 2.5.3). Metals were not
1394 included in the PA/SI analytical suite. However, the metals associated with the munitions used
1395 at this AOC have a low mobility, and if impacts from metals in soil were present, movement to
1396 the groundwater would not be expected. As agreed to in the TPP Memo (Shaw, 2006b), no
1397 groundwater samples were planned or collected during the SI.

1398 **8.4.3.1 Comparison to Background**

1399 As agreed in the TPP Memo (Shaw, 2006b), no groundwater samples were collected from within
1400 the Demolition Area No. 2 AOC during the SI, and no groundwater samples were collected from
1401 the AOC during the PA/SI. However, as discussed in Section 2.5.3, samples were collected
1402 down and cross gradient of the AOC and FUDS. The sampling results indicated that no
1403 explosives were detected in any groundwater sample and perchlorate was detected in 18 of 25
1404 wells sampled in the PA/SI. In the 18 samples with perchlorate detections concentrations ranged
1405 between 0.46 µg/L and 20.7 µg/L. No background value for perchlorate was established in the
1406 PA/SI. However, based on studies completed by the ODEQ and EPA (ODEQ, 2005),
1407 perchlorate is found throughout the lower Umatilla Basin in wells located up, cross and
1408 downgradient of the Boardman AFR. This indicates that the perchlorate detected in groundwater
1409 samples is not originating from sources within this AOC or the Boardman AFR FUDS.

1410 **8.4.3.2 Comparison to Human Health Screening Values**

1411 The DoD action level for perchlorate is 24 µg/L. All detected concentrations of perchlorate in
1412 the vicinity of Boardman AFR FUDS are below the DoD action level.

1413 **8.4.4 Air Pathway**

1414 Air is considered to be a potential pathway due to inhalation of MC in from blowing dust. The
1415 potential inhalation of soil particles is included in the development of health-based screening
1416 values for soil.

1417 **9.0 Impact Area**

1418 **9.1 History and Land Use**

1419 The Impact Area was identified following the TPP meeting. The identification was made
1420 through interviews with a property leaseholder (The Nature Conservancy) and located on aerial
1421 photography. According to The Nature Conservancy, the AOC consists of a number of impact
1422 craters with a small amount of MD. The AOC is locally known as the “Ship in the Desert”.
1423 Apparent impact craters are also visible on aerial photographs (Figure 9-1).

1424 Little is known of the Impact Area and who used it. The extent of the Impact Area is not known
1425 and therefore no boundary is placed on figures presented in this report. One groundwater well is
1426 located approximately 1 mile south (upgradient) of the AOC. The land is currently used as a
1427 wildlife conservation area. Future land use is expected to remain the same as current land use.

1428 The area appears to have been used as an unofficial practice bomb target. Review of historical
1429 and recent aerial photographs does not indicate any established targets. The period of use is
1430 unknown.

1431 **9.2 Previous Investigations**

1432 No previous investigations have been completed at the Impact Area.

1433 **9.3 MEC Evaluation**

1434 The potential munitions used at this AOC are AN-Mk 5, AN-Mk 23, and AN-Mk 43 practice
1435 bombs, which were the standard practice bombs used at Boardman AFR during World War II.
1436 These practice bombs contained black powder and a red or white phosphorus pyrotechnic
1437 spotting charge but contain no sensitive explosive components. The use of other practice bombs
1438 is possible.

1439 **9.3.1 Field Observations and Historical Evidence of MEC**

1440 A limited visual field reconnaissance aided by an all-metal detector for safety was completed at
1441 the Impact Area AOC. The path is shown on Figure 9-1. No MEC or MD was identified and no
1442 impact craters were observed. An employee of the Nature Conservancy stated that MD has been
1443 observed during The Nature Conservancy work in the area.

1444 **9.3.2 MEC Risk Assessment**

1445 The following section presents a qualitative assessment of the risk associated with potential
1446 MEC, as based on historical documentation and limited visual reconnaissance. A MEC
1447 assessment is provided to convey relative risk on a scale from low to high and is not intended to
1448 be a thorough risk assessment as would be conducted for an RI/FS.

1449 Access to the Impact Area is restricted by locked gates and fences. Access is controlled by The
1450 Nature Conservancy.

1451 The MEC risk for the Impact Area AOC is low. This assessment is based on:

- 1452 • No MEC has been reported at this AOC;
- 1453 • No observed accumulations of MD during the SI. However, an employee of The
1454 Nature Conservancy stated that he has observed MD at the AOC;
- 1455 • Munitions assumed to have been used at the Impact Area contain no sensitive
1456 explosive components;
- 1457 • Access to area is only through locked gates.

1458 *9.4 Munitions Constituents Evaluation*

1459 Potential MC at the Impact Area includes metals associated with steel, sheet metal, paint, and
1460 other components of munitions metals (chromium, copper, iron, lead, molybdenum, and nickel)
1461 from bomb bodies. Black powder was the explosive most likely used; however, other explosives
1462 were possibly used.

1463 *9.4.1 Terrestrial Pathway*

1464 Terrestrial receptors may be exposed to MC because soil may have been directly affected the
1465 corrosion of metals from the bomb bodies or explosives used. One surface soil sample (NWO-
1466 030-0012) was proposed and collected from the Impact Area. The samples were analyzed for
1467 select metals (chromium, copper, iron, lead, mercury, molybdenum, and nickel) by EPA Method
1468 6020A. In addition, samples were analyzed for aluminum and manganese for potential use in
1469 evaluating naturally occurring concentrations of metals in soil using the method of Myers and
1470 Thorbjornsen (2004). The two samples from the Demolition Area were also analyzed for
1471 explosives including nitroglycerin by EPA SW-846 Method 8330A (Table 3-1). The sample
1472 location and results are shown on Figures 9-2 and 9-3).

1473 *9.4.1.1 Comparison to Background Data*

1474 Detected metals were compared to background soil concentrations (Table 9-1). There were no
1475 exceedances of background soil concentrations.

1476 *9.4.1.2 Comparison to Human Health Screening Values*

1477 Soil analytical results are only compared to human health screening values if background
1478 concentrations are exceeded. Because there were no exceedances of background concentrations,
1479 no comparison is completed.

1480 *9.4.1.3 Comparison to Ecological Screening Values*

1481 Soil analytical results are only compared to ecological screening values if background
1482 concentrations are exceeded. Because there were no exceedances of background concentrations,

1483 no comparison is completed.

1484 *9.4.2 Surface Water Pathway*

1485 The surface water pathway at Boardman AFR is evaluated through sediments. The potential
1486 receptors for sediments are conservation area workers and wildlife. One sediment sample
1487 (NWO-030-1002) was proposed from this AOC (Figures 9-2 and 9-3). The sediment sample
1488 was analyzed for select metals (chromium, copper, iron, lead, mercury, molybdenum, and nickel)
1489 by EPA Method 6020A. In addition, aluminum and manganese was analyzed as they may be
1490 useful in evaluating naturally occurring concentrations of metals in soil using the method of
1491 Myers and Thorbjornsen (2004). The sediment sample was also analyzed for explosives
1492 including nitroglycerin by EPA SW-846 Method 8330A (Table 3-1).

1493 *9.4.2.1 Comparison to Background Data*

1494 The detected metals concentrations in sediment are listed on Table 9-2. There were no
1495 significant exceedances (greater than three times maximum background concentration) of the SI
1496 background sediment concentrations. No explosive compounds were detected.

1497 *9.4.2.2 Comparison to Human Health Screening Values*

1498 Sediment analytical results are only compared to human health screening values if background
1499 concentrations are significantly exceeded. Because there were no significant exceedances of
1500 background concentrations, no comparison is completed.

1501 *9.4.2.3 Comparison to Ecological Screening Values*

1502 Sediment analytical results are only compared to ecological screening values if background
1503 concentrations are significantly exceeded. Because there were no significant exceedances of
1504 background concentrations, no comparison is completed.

1505 *9.4.3 Groundwater Pathway*

1506 The TPP Memo (Shaw 2006b) indicated that groundwater was a potentially affected media, with
1507 potential receptors located downgradient of the FUDS boundary. No groundwater drinking
1508 water wells are within the AOC, but drinking water wells are located downgradient of the Impact
1509 Area AOC. As discussed in the TPP Memo, the PA/SI addressed the groundwater pathway for
1510 the Boardman AFR, and sufficient data exist to assess groundwater. Section 2.5.3 of this SI
1511 report presents the results of the PA/SI sampling.

1512 Groundwater samples were collected within, downgradient, and cross gradient of the Boardman
1513 AFR. A total of 25 groundwater samples were collected from the area within and surrounding
1514 the Boardman AFR. Four of the samples were located on the Boardman AFR FUDS. Samples
1515 were analyzed for explosive compounds and perchlorate (see Section 2.5.3). Metals were not
1516 included in the PA/SI analytical suite. However, the metals associated with the munitions used
1517 at this AOC have a low mobility, and if impacts from metals in soil were present movement to

1518 the groundwater would not be expected. As agreed to in the TPP Memo (Shaw, 2006b), no
1519 groundwater samples were planned or collected during the SI.

1520 *9.4.3.1 Comparison to Background*

1521 As agreed in the TPP Memo (Shaw, 2006b), no groundwater samples were collected from within
1522 the Impact Range AOC during the SI and no groundwater samples were collected from the AOC
1523 during the PA/SI. However, as discussed in Section 2.5.3, samples were collected down and
1524 cross gradient of the AOC and FUDS. The sampling results indicated that no explosives were
1525 detected in any groundwater sample and perchlorate was detected in 18 of 25 wells sampled in
1526 the PA/SI. In the 18 samples with perchlorate detections concentrations ranged between 0.46
1527 $\mu\text{g/L}$ and 20.7 $\mu\text{g/L}$. No background value for perchlorate was established in the PA/SI.
1528 However, based on studies completed by the ODEQ and EPA (ODEQ, 2005), perchlorate is
1529 found throughout the lower Umatilla Basin in wells located up, cross and downgradient of the
1530 Boardman AFR. This indicates that the perchlorate detected in groundwater samples is not
1531 originating from sources within this AOC or the Boardman AFR FUDS.

1532 *9.4.3.2 Comparison to Human Health Screening Values*

1533 The DoD action level for perchlorate is 24 $\mu\text{g/L}$. All detected concentrations of perchlorate in
1534 the vicinity of Boardman AFR FUDS are below the DoD action level.

1535 *9.4.4 Air Pathway*

1536 Air is considered to be a potential pathway due to inhalation of MC in from blowing dust. The
1537 potential inhalation of soil particles is included in the development of health-based screening
1538 values for soil.

1539 **10.0 Summary and Conclusions**

1540 The conclusions of the SI are presented in this section. Recommendations are presented in
 1541 Section 11.0. Updated CSMs are presented in Appendix J.

1542 The six AOCs at Boardman AFR include Target No. 1, Target No. 2, Carty Reservoir Bomb
 1543 Target, Range Complex No. 1, Demolition Area No. 2, and the Impact Area. The former
 1544 Boardman AFR is included on the MMRP Inventory in the *Defense Environmental Programs*
 1545 *Annual Report to Congress Fiscal Year 2006* (DoD, 2006), and in the *ASR Supplement*
 1546 (USACE, 2004b), with four identified ranges and three subranges as follows:

Range Name	Range ID	Approximate Area (acres)	UTM Coordinates* (meters)
Target No. 1	F10OR016001R01	649	N 5063404; E 279733
Target No. 2	F10OR016001R02	649	N 5072555; E 280149
Carty Reservoir Bomb Target	F10OR016001R03	649	N 5061866; E 279539
Range Complex No. 1	F10OR016001R03	9,505	N 5072555; E 280149
INPR Site No. 1	F10OR016001R03-SR01	536	N 5072555; E 280149
Demolition Area	F10OR016001R03-SR02	157	N 5072555; E 280149
Turret Gunnery Training Range	F10OR016001R03-SR03	9,443	N 5072555; E 280149

1547 *Coordinates for the ranges are in UTM Zone 11N, NAD 1983.

1548 Of the 649 total acres reported for the Carty Reservoir Bomb Target, the ASR Supplement
 1549 indicates 325 acres were on land and 324 acres were water acres. In addition to the four ranges
 1550 and three subranges, two other areas which were not identified in the range inventory, were
 1551 evaluated in this SI. The two areas including coordinates are as follows:

- 1552 ▪ Demolition Area No. 2 N 5065433; E 284894
- 1553 ▪ Impact Area N 5059240; E 282333

1554 **10.1 Target No. 1**

1555 A visual reconnaissance of Target No. 1 was conducted prior to collecting a soil sample. MD,
 1556 likely from a M38A2 practice bomb was identified. Previously MD was identified during the

1557 INPR site visit. No MEC has been identified at this AOC. The risk for potential MEC at Target
1558 No. 1 is considered to be low based on the following:

- 1559 • No MEC has ever been reported or found;
- 1560 • MD has been reported for this AOC;
- 1561 • The reported munitions used at this AOC are practice munitions only;
- 1562 • The munitions used at this target used relatively insensitive explosive components;
- 1563 • The area is used for farming, undergoing yearly tillage to depths of approximately 18
1564 inches without MEC discovery; and
- 1565 • The unfenced area is not frequented by the public and only farm workers of PGE workers
1566 have access to the area.

1567 One surface soil sample was collected from Target No. 1 and analyzed for select metals and
1568 explosives. Detected results were compared to background concentrations and there were no
1569 exceedances of background and there were no detections of explosive compounds. Because
1570 there were no exceedances of background concentrations, no comparison to human health or
1571 ecological screening values was completed. No surface water or sediment samples were
1572 collected from this AOC. Surface water and sediments were addressed under the adjacent Carty
1573 Reservoir Bomb Target (Section 10.3)

1574 During the 2004 Weston PA/SI groundwater samples were collected from two wells located in
1575 the vicinity of the Target No. 1. One well was located upgradient of Target No.1 and one well
1576 was located within the Target No. 1 AOC boundary. Samples were analyzed for perchlorate. In
1577 addition, both of these wells are sampled annually by PGE for metals. Analytical results indicate
1578 that metals in the groundwater from the well located within Target No. 1 were below the
1579 background well concentrations. An exception to this was for iron which significantly exceeded
1580 (three times the background concentration) the background concentration. However, the
1581 concentration was well below the human health screening value. In addition, iron was not
1582 detected in soil at concentrations that above soil background concentrations. Molybdenum and
1583 nickel were not included in the groundwater analytical suite completed by PGE and no
1584 evaluation was completed for these analytes of concern. Perchlorate was detected in the
1585 upgradient well but not the downgradient well. The detection in the upgradient well was below
1586 the DoD action level.

1587 *10.2 Target No. 2*

1588 No MEC or MD was identified during the SI field activities. MEC has been identified as
1589 recently as Spring 2006 and destroyed by a Navy EOD unit. MD was observed during the ASR
1590 field visit. The risk for potential MEC at Target No. 2 is considered to be moderate based on the
1591 following:

- 1592 • MEC has been reported as recently as March 2006, recent finds were AN-M57 GP
1593 practice bombs;
- 1594 • All munitions contained relatively insensitive explosive components except for the AN-
1595 M57 which may have had a sensitive fuze;
- 1596 • The area is used for farming, undergoing yearly tillage to depths of approximately 18
1597 inches and MEC is periodically unearthed;
- 1598 • The unfenced area is frequented by farm workers; the general public does not have
1599 routine access to the AOC.

1600 Two surface soil samples were collected during the SI field activities and analyzed for select
1601 metals and explosives. In addition, two surface soil samples (and two subsurface soil samples
1602 were collected from this AOC during the PA/SI (Weston, 2004). The PA/SI samples were
1603 analyzed for metals and perchlorate. Analytical results for metals for all soil samples were
1604 below Boardman AFR background values. There were no explosive or perchlorate detections.

1605 No surface water or sediment samples were collected during the SI field activities at Target No.
1606 2. Five surface water samples and one sediment sample were collected during the PA/SI from
1607 locations located west of the Target No. 2. The surface water samples were analyzed for
1608 perchlorate and the sediment sample was analyzed for metals. Perchlorate was detected in all
1609 surface water samples. All concentrations were below the DoD action level. The highest
1610 perchlorate concentration was in the most upstream sample and the lowest was in the most
1611 downstream sample. The most upstream sample location is upstream of all FUDS AOCs. These
1612 results indicate that the source of perchlorate in Sixmile Canyon Creek is not from FUDS related
1613 activity. The metals analytical results from the sediment sample were below background
1614 concentration.

1615 *10.3 Carty Reservoir Bomb Target*

1616 No MEC or MD was observed during the SI field activities. During the ASR field visit, large
1617 amounts of MD were observed as well as relatively intact, fuzed and suspected live munitions.
1618 The risk for potential MEC at Carty Reservoir Bomb Target is considered to be moderate based
1619 on the following:

- 1620 • MEC was reported during the ASR in 1995;
- 1621 • The M75/M84 target marker bombs may have contained sensitive fuzing;
- 1622 • The area is used for farming, undergoing yearly tillage to depths of approximately 18
1623 inches;
- 1624 • The unfenced area is frequented by farm workers; the general public does not have
1625 routine access to the AOC.

1626 Two surface soil samples were collected during the SI field activities and analyzed for select
1627 metals. One of the two samples was also analyzed for explosives. Metal analytical results were
1628 all below Boardman AFR background values. There were no explosives detections. One
1629 sediment sample was collected during the SI field activities and analyzed for select metals and
1630 explosives. Metals analytical results were all below background concentrations. There were no
1631 explosive detections. A surface water sample was collected from Carty Reservoir during the
1632 PA/SI (Weston, 2004). The sample was analyzed for perchlorate. There was no perchlorate
1633 detected.

1634 *10.4 Range Complex No. 1*

1635 Range Complex Consists of three subranges: INPR Site No. 1, the Demolition Area, and the
1636 Turret Gunnery Training Range. Historically, MD has been reported at both INPR Site No. 1 (a
1637 former bombing target) and the Demolition Area. During the SI Field work MD was observed at
1638 the Demolition Area. No MEC has been reported at Range Complex No. 1. No MD was
1639 observed or has been reported within the Turret Gunnery Training Range. The risk for potential
1640 MEC at Range Complex No. 1 is considered to be moderate based on the following:

- 1641 • Munitions debris has been reported at INPR Site No. 1 and the Demolition area;
- 1642 • The BLU-73 that was located at INPR Site No. 1 contains extremely sensitive explosive
1643 components. Munitions were likely drift over from the adjacent Navy Range activities;
- 1644 • Detonation cord used at the Demolition area contains sensitive explosive components;
- 1645 • A portion of the area is used for farming, undergoing yearly tillage to depths of
1646 approximately 18 inches.
- 1647 • Access to portions of INPR Site No. 1 and all of the Demolition Area are controlled by
1648 security personnel. The remainder of the area of INPR Site No. 1 is controlled by locked
1649 gates. All irrigated agricultural areas are frequented by farm workers: the general public
1650 does not have routine access to the AOC.

1651 Two soil samples each were collected from the Demolition Area and the Turret Gunnery
1652 Training Range during the SI field activities. The two samples from the Demolition Area were
1653 analyzed for select metals and explosives and the two samples from the Turret Gunnery Training
1654 Range were analyzed for select metals only. Two samples were also collected during the PA/SI
1655 (Weston, 2004) at INPR Site No. 1 and analyzed for metals, explosives, and perchlorate. Metals
1656 analytical results for all samples were below Boardman AFR background concentrations. There
1657 were no detections of explosives or perchlorate.

1658 No groundwater samples were collected from Range Complex No. 1. However the PA/SI
1659 (Weston, 2004) collected groundwater sample from wells located cross and down gradient of the
1660 FUDS. Samples were analyzed for explosives and perchlorate. There were no explosive
1661 detections. Perchlorate was detected in 18 of 25 wells sampled. All results were below the DoD

1662 action level. The ODEQ has identified perchlorate in groundwater throughout the lower
1663 Umatilla Basin in wells located 10 of miles from the Boardman AFR (ODEQ, 2005). Based on
1664 studies completed by the ODEQ and EPA (ODEQ, 2005), perchlorate is found throughout the
1665 lower Umatilla Basin in wells located up, cross and downgradient of the Boardman AFR. This
1666 indicates that the perchlorate detected in groundwater samples is not originating from sources
1667 within this AOC or the Boardman AFR FUDS.

1668 *10.5 Demolition Area No. 2*

1669 MEC has been identified within the Demolition Area No. 2 vicinity as recently as June 2006. A
1670 visual reconnaissance of the area was completed during the SI field activities and large quantities
1671 of MD were observed in the area of the disposal pits. Based on the reported presence of MEC
1672 and MD, the risk for potential MEC is considered moderate based on the following:

- 1673 ▪ Recent find and demolition of a M83 butterfly bomb by Oregon State Police EOD Unit;
- 1674 ▪ Observed accumulations of MD;
- 1675 ▪ Sensitive fuzes contain in reported MEC and MD;
- 1676 ▪ Access through locked gates but unpatrolled.

1677 Two soil samples were collected from Demolition Area No. 2 and analyzed for select metals and
1678 explosives. All metals detections were below Boardman AFR background concentrations.
1679 There were no explosive detections.

1680 No groundwater sample were collected from Demolition Area No. 2. However the PA/SI
1681 (Weston, 2004) collected groundwater sample from wells located cross and down gradient of the
1682 FUDS. Samples were analyzed for explosives and perchlorate. There were no explosive
1683 detections. Perchlorate was detected in 18 of 25 wells sampled. All results were below the DoD
1684 action level. The ODEQ has identified perchlorate in groundwater throughout the lower
1685 Umatilla Basin in wells located 10 of miles from the Boardman AFR (ODEQ, 2005). Based on
1686 studies completed by the ODEQ and EPA (ODEQ, 2005), perchlorate is found throughout the
1687 lower Umatilla Basin in wells located up, cross and downgradient of the Boardman AFR. This
1688 indicates that the perchlorate detected in groundwater samples is not originating from sources
1689 within this AOC or the Boardman AFR FUDS.

1690 *10.6 Impact Area*

1691 MD has been reported by workers in the vicinity of the Impact Area. No MEC has been
1692 reported. No MEC or MD was identified during the SI field visual reconnaissance. The risk for
1693 potential MEC at the Impact Area is considered to be low based on the following:

- 1694 ▪ No MEC has been reported at this AOC;

- 1695 ▪ No observed accumulations of MD during the SI. However, an employee of The Nature
1696 Conservancy stated that he has observed MD at the AOC;
- 1697 ▪ Munitions assumed to have been used at the Impact Area contain no sensitive explosive
1698 components;
- 1699 ▪ Access to area is only through locked gates.

1700 One soil sample and one sediment sample were collected from the Impact Area. Samples were
1701 analyzed for select metals and explosives. All metals results were below Boardman AFR
1702 background concentrations and no explosives were detected.

1703 No groundwater samples were collected from the Impact Area. However the PA/SI (Weston,
1704 2004) collected groundwater sample from wells located cross and down gradient of the FUDS.
1705 Samples were analyzed for explosives and perchlorate. There were no explosive detections.
1706 Perchlorate was detected in 18 of 25 wells sampled. All results were below the DoD action
1707 level. The ODEQ has identified perchlorate in groundwater throughout the lower Umatilla Basin
1708 in wells located 10 of miles from the Boardman AFR (ODEQ, 2005). Based on studies
1709 completed by the ODEQ and EPA (ODEQ, 2005), perchlorate is found throughout the lower
1710 Umatilla Basin in wells located up, cross and downgradient of the Boardman AFR. This
1711 indicates that the perchlorate detected in groundwater samples is not originating from sources
1712 within this AOC or the Boardman AFR FUDS.

1713 ***11.0 Recommendations***

1714 Results of the SI provide the basis for conclusions and/or recommendations for further actions at
1715 each of the AOCs.

1716 ***11.1 Target No. 1***

1717 Based on historical evidence and results from the SI field activities, there is potential for MEC at
1718 Target No. 1. Analytical results indicate that all soil metals results are below Boardman AFR
1719 background values and no explosives were detected. Groundwater analytical results indicate that
1720 metals concentrations are similar to background, with the exception of iron which was above the
1721 background value but below the human health screening value. In addition, iron is not a
1722 CERCLA hazardous substance, and therefore a recommendation based on iron alone cannot be
1723 used to recommend RI/FS. Perchlorate was not detected in the groundwater sample from within
1724 the AOC. Based on the potential for MEC, a recommendation for RI/FS is made for Target
1725 No. 1.

1726 ***11.2 Target No. 2***

1727 Based on historical evidence and recent MEC finds, there is potential for MEC at Target No. 2.
1728 Analytical results indicate that all soil metals results are below Boardman AFR background
1729 values and no explosives were detected. While PA/SI (Weston, 2004) surface water analytical
1730 results indicate that perchlorate is present, the upstream sampling locations with the highest
1731 perchlorate concentrations indicate that the perchlorate is not from Target No. 2 or any other
1732 known FUDS AOC. Based on the potential for MEC, a recommendation for RI/FS is made for
1733 Target No. 2.

1734 ***11.3 Carty Reservoir Bomb Target***

1735 Based on historical evidence, there is potential for MEC at Carty Reservoir Bombing Target.
1736 Analytical results indicate that all soil metals results are below Boardman AFR background
1737 values and no explosives were detected. Surface water and sediment sample analytical results
1738 indicate that there are no observed adverse impacts. Based on the potential for MEC, a
1739 recommendation for RI/FS is made for Carty Reservoir Bombing Target.

1740 ***11.4 Range Complex No. 1***

1741 Based on historical evidence and results from the SI field activities, there is potential for MEC at
1742 Range Complex No.1. Analytical results indicate that all soil metals results are below Boardman
1743 AFR background values and no explosives or perchlorate were detected, indicating no observed
1744 adverse impacts from MC at Range Complex No. 1. Based on the potential for MEC, a
1745 recommendation for RI/FS is made for Range Complex No. 1.

1746 **11.5 Removal Actions**

1747 Section 1.3 identified as one of the decision rules, evaluation of whether a removal action is
1748 warranted. A removal action would be warranted if a high MEC hazard or elevated MC risk was
1749 identified. There is no indication that a high MEC risk is present at Boardman AFR. No MEC
1750 was found or identified during the SI. MEC has been identified on remote and restricted access
1751 lands as recently as spring 2006. The exposure risk for MEC was evaluated to be moderate.
1752 Therefore, a removal action is not recommended for the Boardman AFR.

1753 **11.6 Munitions Response Areas**

1754 Results of the SI field activities provide the basis for identifying MRSs and, as appropriate,
1755 munitions response areas (MRAs) and for scoring each MRS using the MRSPP. A MRA is any
1756 area on a defense site that is known or suspected to contain MEC or MC, and may contain one or
1757 more MRS.

1758 Based on the use and physical distribution of the AOCs at Boardman AFR, four MRSs are
1759 identified (Figure 11-1):

- 1760 1. MRS #1 – Target No. 1.
1761 2. MRS #2 – Target No. 2.
1762 3. MRS #3 – Carty Reservoir Bomb Target.
1763 4. MRS #4 – Range Complex No. 1.

1764 MRSPP scoring is provided in Appendix K.

1765 For the purposes of scoring, the Range Inventory list is used, as per USACE direction. MRS No.
1766 1 - Target No. 1 consists of the area shown in the Range Inventory. MRS No. 2 is Target No. 2,
1767 MRS No. 3 is the Carty Reservoir Bomb Target, and MRS No. 4 is the Range Complex No. 1
1768 which includes INPR Site No. 1, the Demolition Area, and the Turret Gunnery Range.

1769 Based on USACE guidance, only those ranges identified in the *Defense Environmental*
1770 *Programs Annual Report to Congress Fiscal Year 2006* (DoD, 2006) are assigned to an
1771 MRA/MRS and scored using the MRSPP protocols until DoD can determine the eligibility of the
1772 other AOCs. Recommendations for identification for those remaining AOC are provided below:

- 1773 • Demolition Area No. 2 – Recommended to be identified as an MRS. The area has
1774 been used as a munitions demolition area as evidenced by several rows of detonation
1775 craters and a high density of MD. MEC was located and destroyed in June 2006.
1776 The MEC risk is considered to be moderate. Access to this area is restricted by the
1777 property leaseholder The Nature Conservancy.
- 1778 • Impact Area – Recommended to be identified as an MRS. The area may have been
1779 used for unregulated practice bombing. The Nature Conservancy workers have stated
1780 that MD from practice bombs has been found in the area. The SI field team did not
1781 identify any craters or MD.

1782 It is recommended that areas where MEC has been reported but are not included in the four
1783 MRSs presented above or the two additional AOCs recommended for identification as an MRS,
1784 be further investigated to determine whether additional MEC is present in the vicinity.

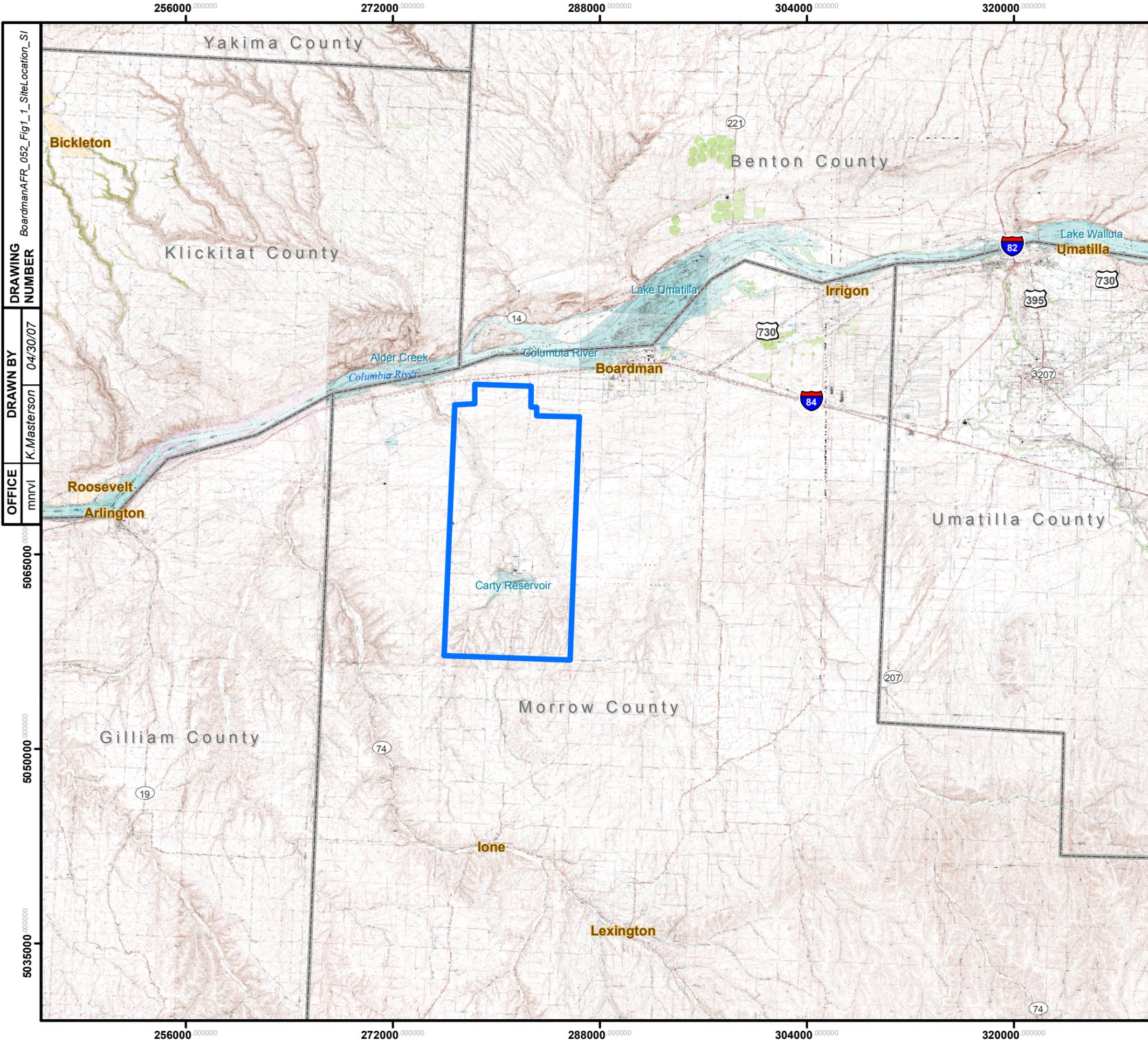
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1790 [bin/getdoc.cgi?dbname=browse_usc&docid=Cite:+10USC2701](http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=browse_usc&docid=Cite:+10USC2701)
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Figures

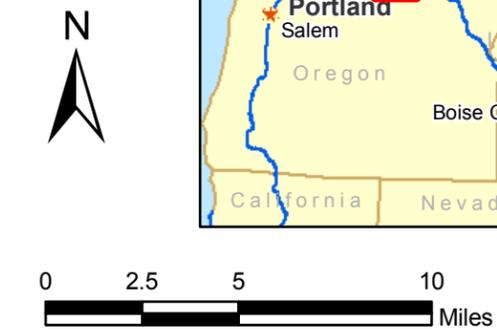


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 K.Masterson
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Legend

 Boardman Air Force Range FUDS Boundary

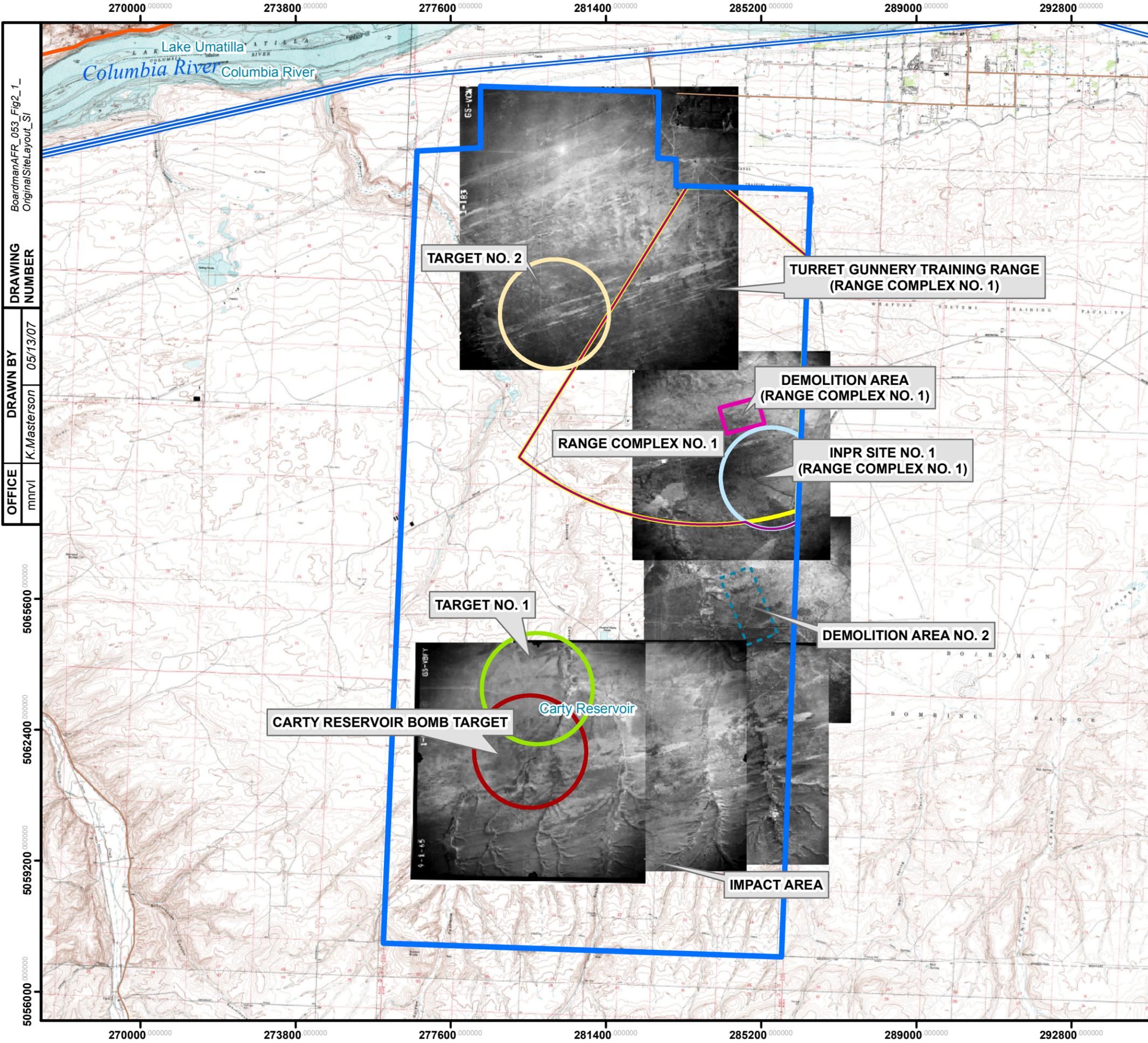
NOTES:
 1) FUDS boundary was derived from the Boardman AFR ASR Supplement.
 2) Topographic maps (Gilliam, Morrow, Umatilla, Klickitat, and Benton Counties) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.



REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

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FIGURE 1-1
SITE LOCATION
 BOARDMAN AIR FORCE RANGE



BoardmanAFR_053_Fig2_1_OriginalSiteLayout_Sl

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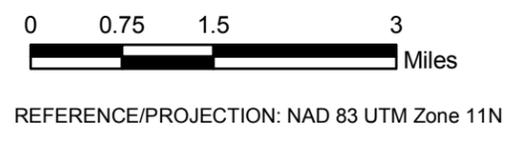
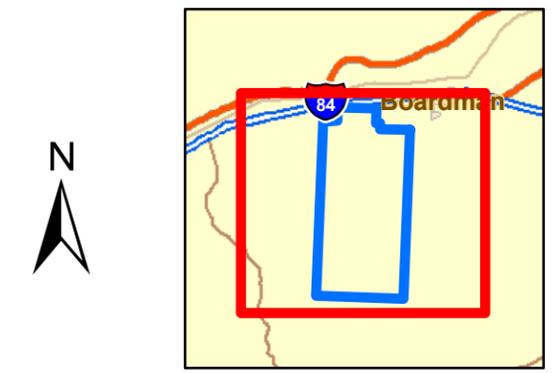
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Legend

- Boardman Air Force Range FUDS Boundary
- Ranges Included in the MMRP Range Inventory**
- Target No. 1
- Target No. 2
- Carty Reservoir Bomb Target
- Range Complex No. 1
- INPR Site No. 1 (Range Complex No. 1)
- Demolition Area (Range Complex No. 1)
- Turret Gunnery Training Range (Range Complex No. 1)
- Additional Areas Identified During Technical Planning**
- Demolition Area No. 2 (boundary not verified)
- Impact Area (boundary not defined)

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photographs obtained from the U.S. Geological Survey and are dated 1965 and 1970.
- 3) Topographic map (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.



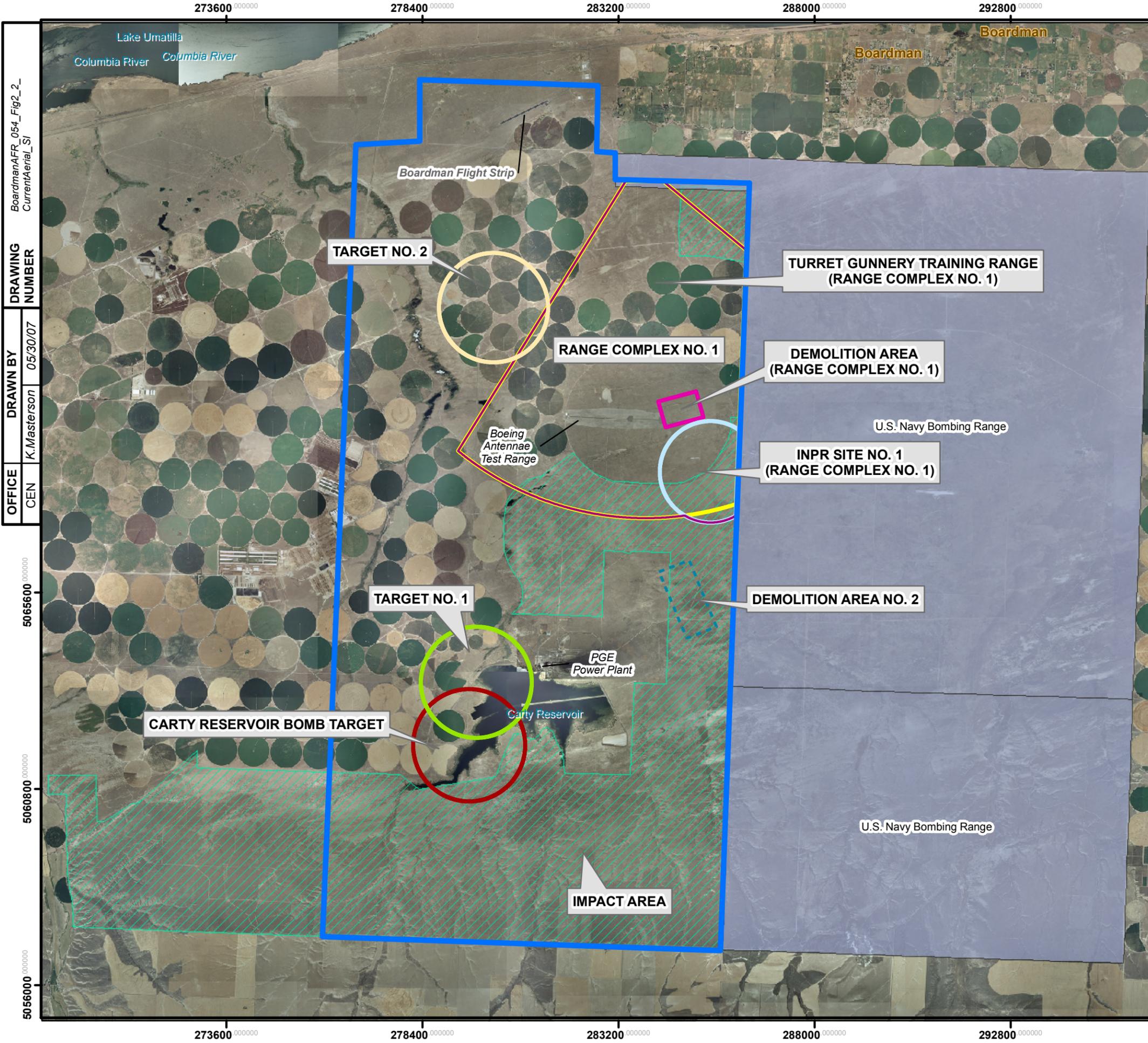

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FIGURE 2-1

ORIGINAL SITE LAYOUT

BOARDMAN AIR FORCE RANGE





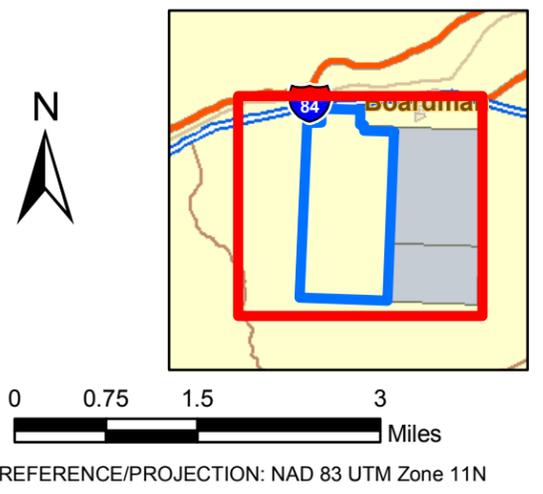
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 DATE: 05/30/07
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- Boardman Air Force Range FUDS Boundary
- Active U.S. Navy Bombing Range
- Ranges Included in the MMRP Range Inventory**
- Target No. 1
- Target No. 2
- Carty Reservoir Bomb Target
- Range Complex No. 1
- INPR Site No. 1 (Range Complex No. 1)
- Demolition Area (Range Complex No. 1)
- Turret Gunnery Training Range (Range Complex No. 1)
- Additional Areas Identified During Technical Planning**
- Demolition Area No. 2 (boundary not verified)
- Impact Area (boundary not defined)
- The Nature Conservancy Lease

NOTES:

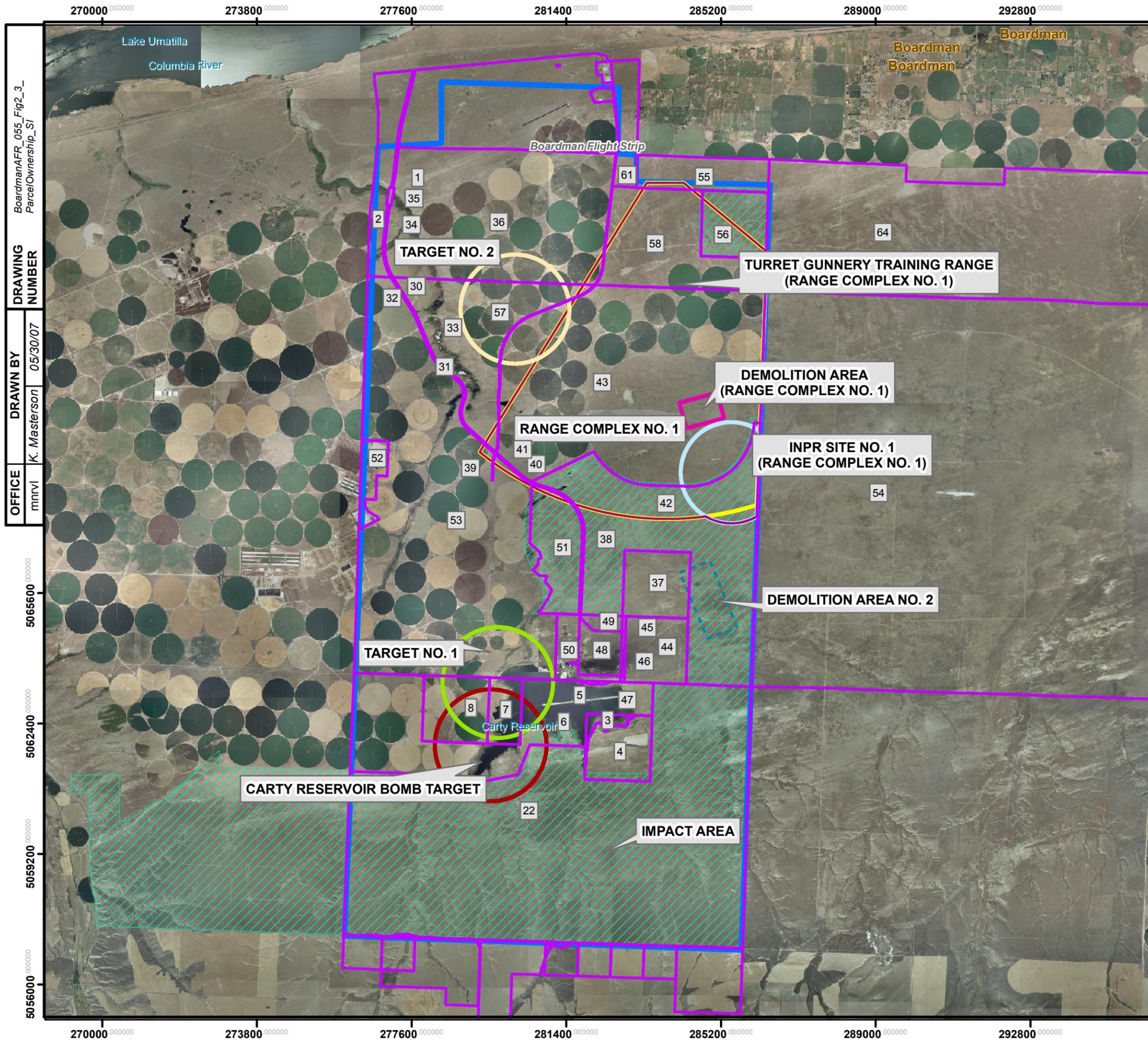
- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



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FIGURE 2-2
CURRENT AERIAL PHOTOGRAPH
 BOARDMAN AIR FORCE RANGE

Shaw Shaw Environmental, Inc.



Legend

- Boardman Air Force Range FUDS Boundary
- Parcel Ownership Boundary
- The Nature Conservancy Lease

Ranges Included in the MMRP Range Inventory

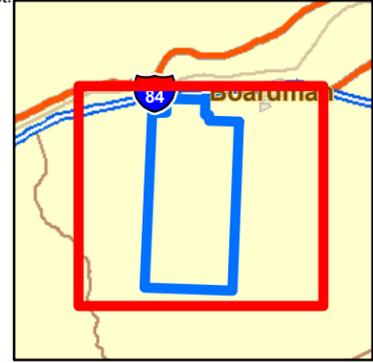
- Target No. 1
- Target No. 2
- Carty Reservoir Bomb Target
- Range Complex No. 1
- INPR Site No. 1 (Range Complex No. 1)
- Demolition Area (Range Complex No. 1)
- Turret Gunnery Training Range (Range Complex No. 1)

Additional Areas Identified During Technical Planning

- Demolition Area No. 2 (boundary not verified)
- Impact Area (boundary not defined)

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.
- 3) ²³ Indicates parcel ownership which is available from the USACE Seattle District.



REFERENCE/PROJECTION: NAD 83 UTM Zone 11N



U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 2-3
PARCEL OWNERSHIP
BOARDMAN AIR FORCE RANGE

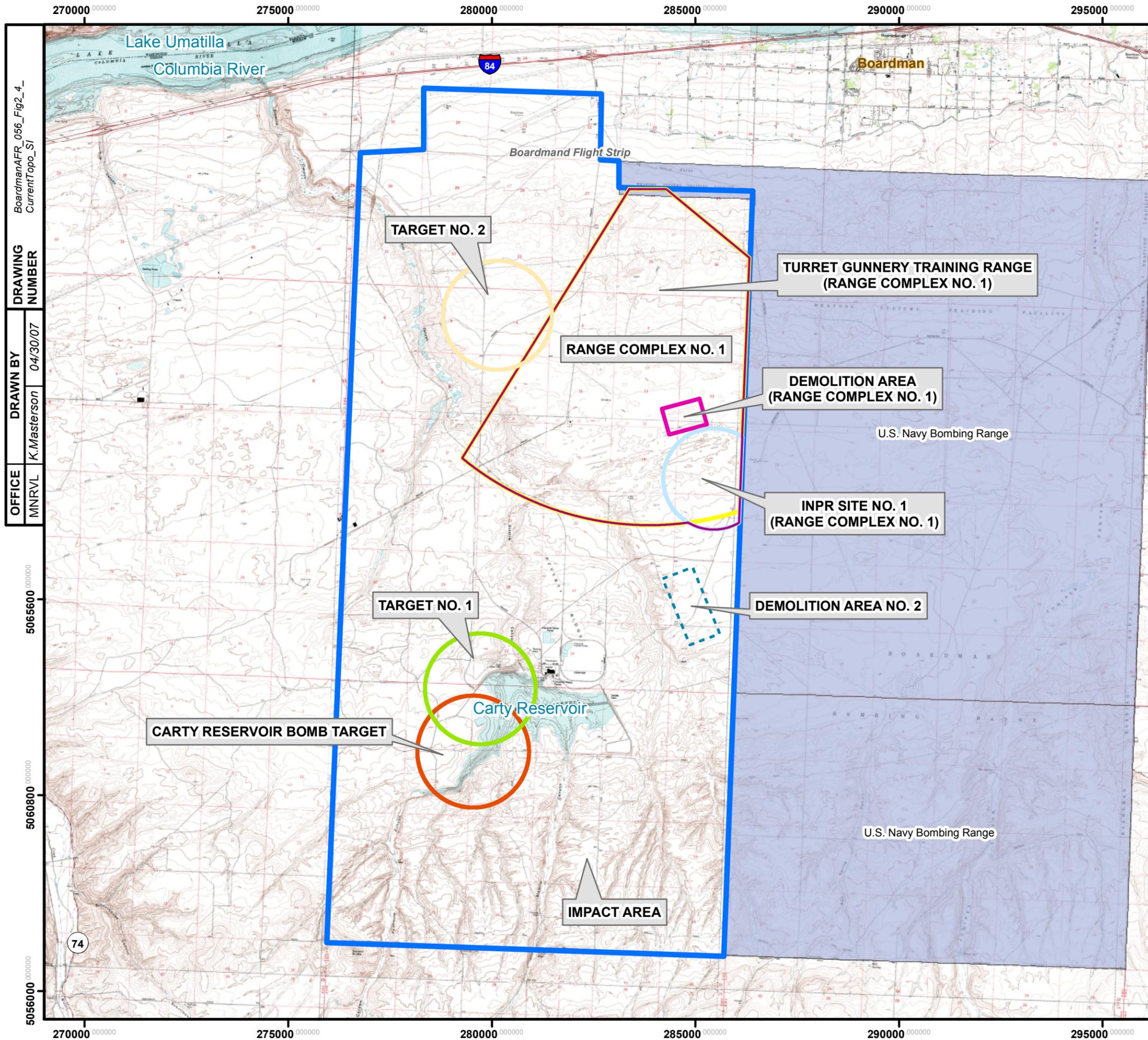


BOARDMAN AFR_065_Fig2_3_
 Parcel/Ownership_Sf
 DRAWING NUMBER
 DRAWN BY
 K. Masterson | 05/30/07
 OFFICE
 mmrvl

270000 000000 273800 000000 277600 000000 281400 000000 285200 000000 289000 000000 292800 000000

5076400 000000
 5075200 000000
 5072000 000000
 5068800 000000
 5065600 000000
 5062400 000000
 5059200 000000
 5056000 000000

270000 000000 273800 000000 277600 000000 281400 000000 285200 000000 289000 000000 292800 000000



BoardmanAFR_056_Fig2_4_ CurrentTopo_SI
 DRAWING NUMBER
 DRAWN BY K.Masterson 04/30/07
 OFFICE MNRVL

Legend

- Boardman Air Force Range FUDS Boundary
- Active U.S. Navy Bombing Range
- Ranges Included in the MMRP Range Inventory**
- Target No. 1
- Target No. 2
- Carty Reservoir Bomb Target
- Range Complex No. 1
- INPR Site No. 1 (Range Complex No. 1)
- Demolition (Range Complex No. 1)
- Turret Gunnery Training Range (Range Complex No. 1)
- Additional Areas Identified During Technical Planning**
- Demolition Area No. 2 (boundary not verified)
- Impact Area (boundary not defined)

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Topographic map (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.

N

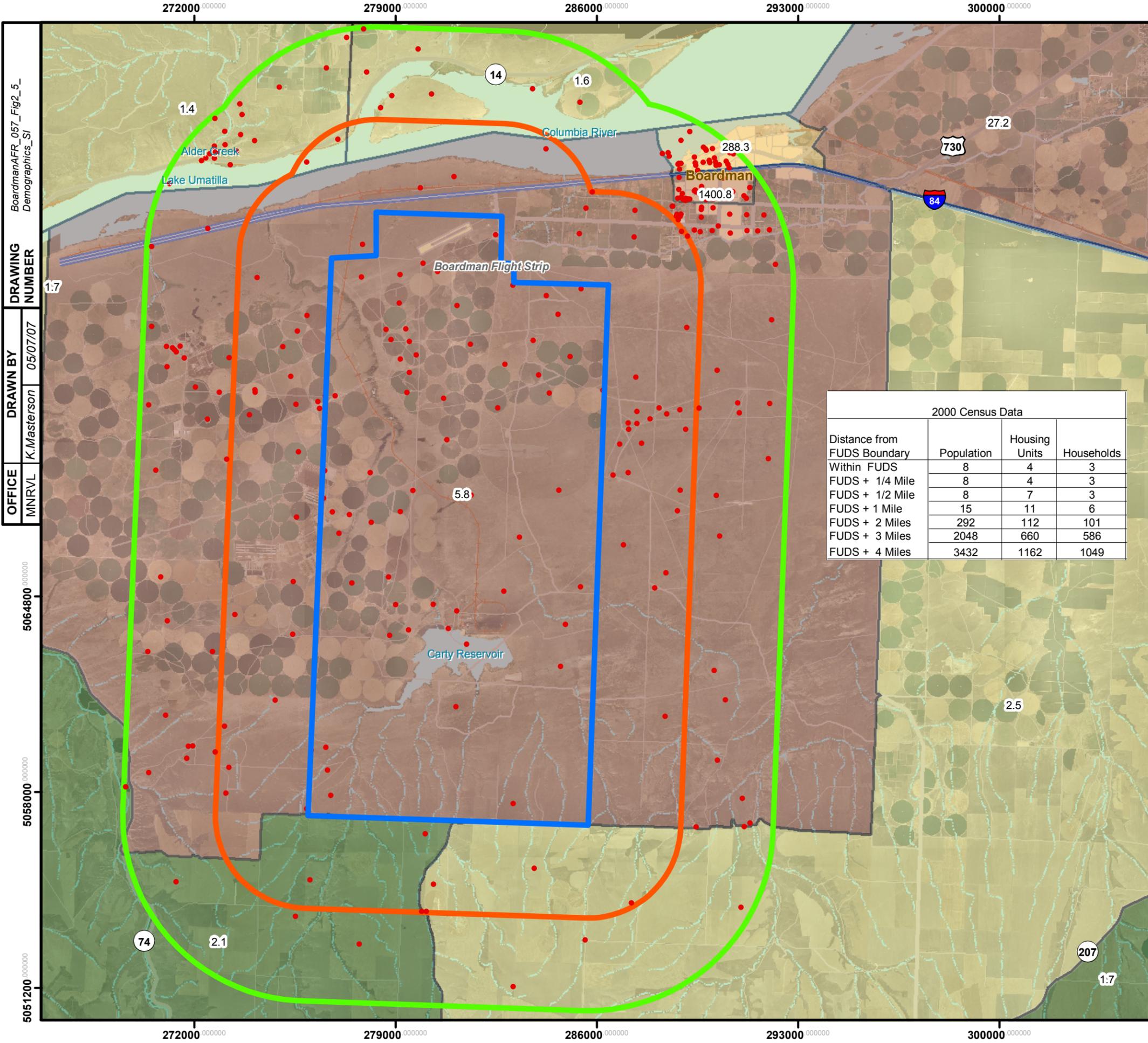
0 0.75 1.5 3 Miles

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 2-4
CURRENT TOPOGRAPHIC MAP
 BOARDMAN AIR FORCE RANGE

Shaw Environmental, Inc.



BoardmanAFR_057_Fig2_5_
 Demographics_Sl
DRAWING NUMBER
 DRAWN BY
 K.Masterson
 05/07/07
OFFICE
 MNRVL

Legend

- Boardman Air Force Range FUDS Boundary
- 4-Mile Radius From Boardman Air Force Range FUDS Boundary

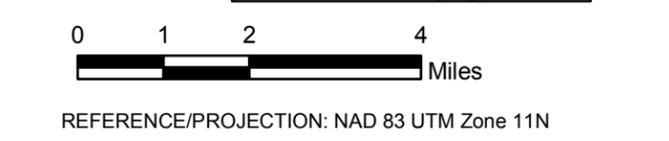
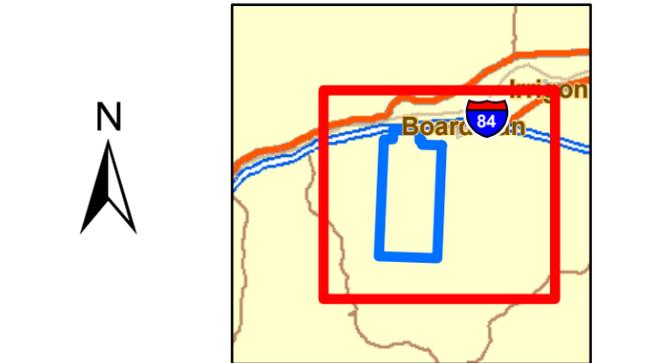
2004 Census Block Group Population

- 0-600
- 601 - 1000
- 1001 - 1400
- 1401 - 1800
- 1801 - 2800

- Census Block Centroid Unit
- 25 Number of People Per Square Mile

NOTES:

- 1) FUDS boundary was derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.
- 3) Census data obtained from StreetMap, ESRI, 2005. The population density for Morrow county is 5.4, 5.8 person per sq mile for 2000, 2004; respectively.

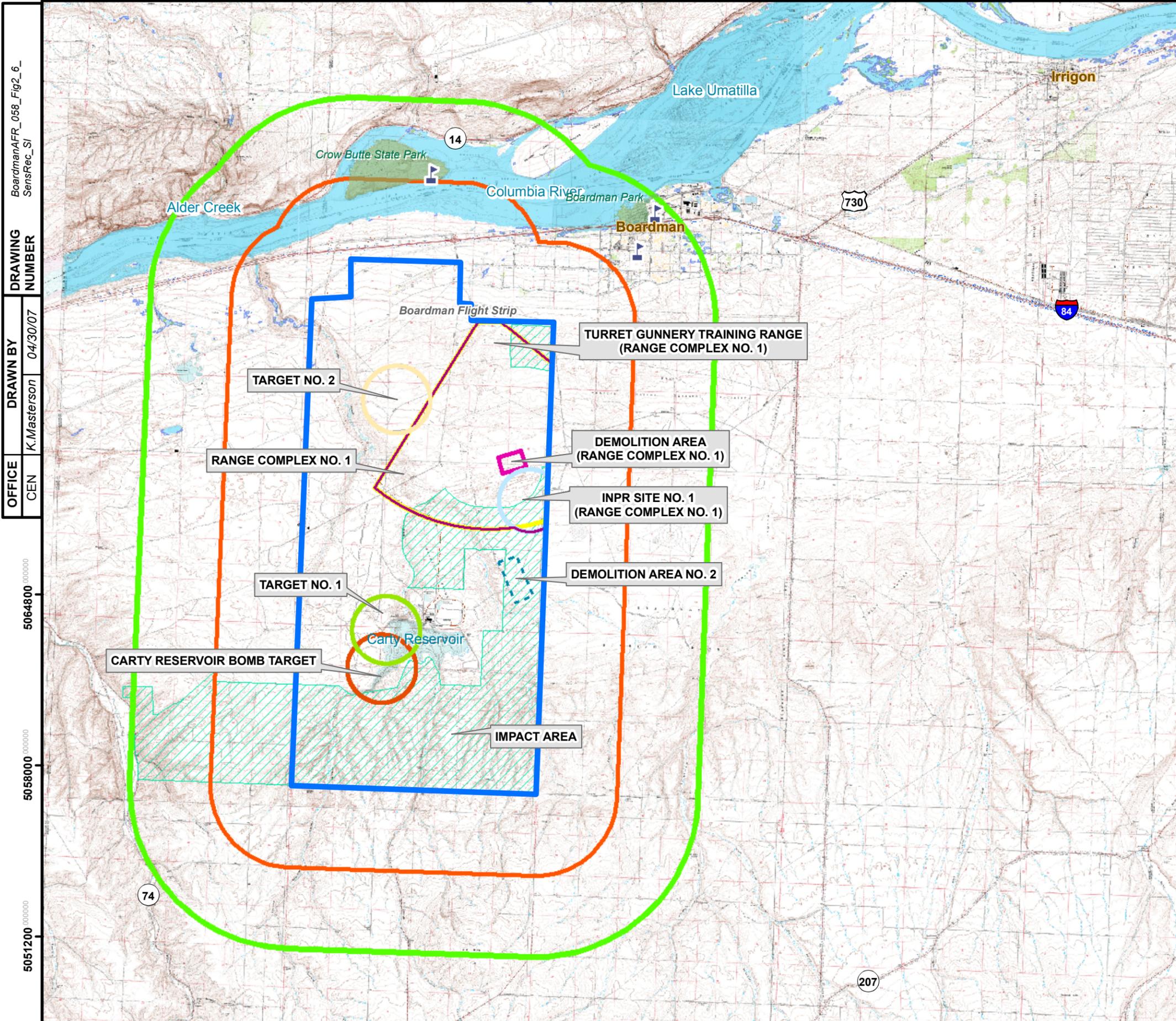


U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 2-5
CENSUS DATA WITHIN 4-MILE RADIUS
 BOARDMAN AIR FORCE RANGE

Shaw Shaw Environmental, Inc.

272000 000000 279000 000000 286000 000000 293000 000000 300000 000000 307000 000000



BoardmanAFR_058_Fig2_6_
SensRec_SI

DRAWING NUMBER

DRAWN BY
K.Masterson 04/30/07

OFFICE
CEN

Legend

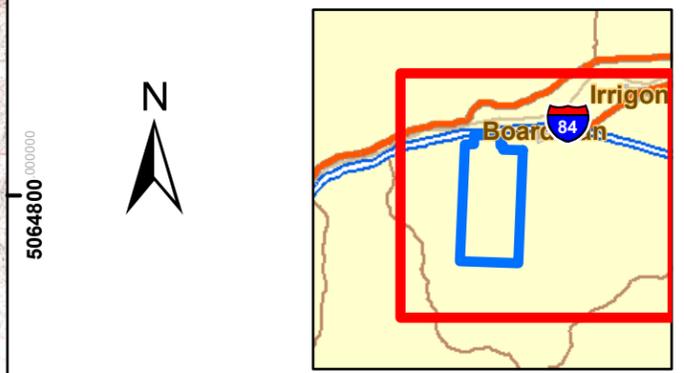
- Boardman Air Force Range FUDS Boundary
- 4-Mile Radius From Boardman Air Force Range FUDS Boundary
- 2-Mile Radius From Boardman Air Force Range FUDS Boundary
- Park
- School

Wetland Type

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- The Nature Conservancy Lease

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Wetlands data obtained from the U.S. Fish and Wildlife Service, 200605, NWIDBA.CONUS_wet_poly: Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC. FWS/OBS-79/31., U.S. Fish and Wildlife Service, Branch of Habitat Assessment, Washington, D.C.
- 3) Topographic map (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.



0 1.25 2.5 5 Miles

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

U.S. ARMY CORPS OF ENGINEERS
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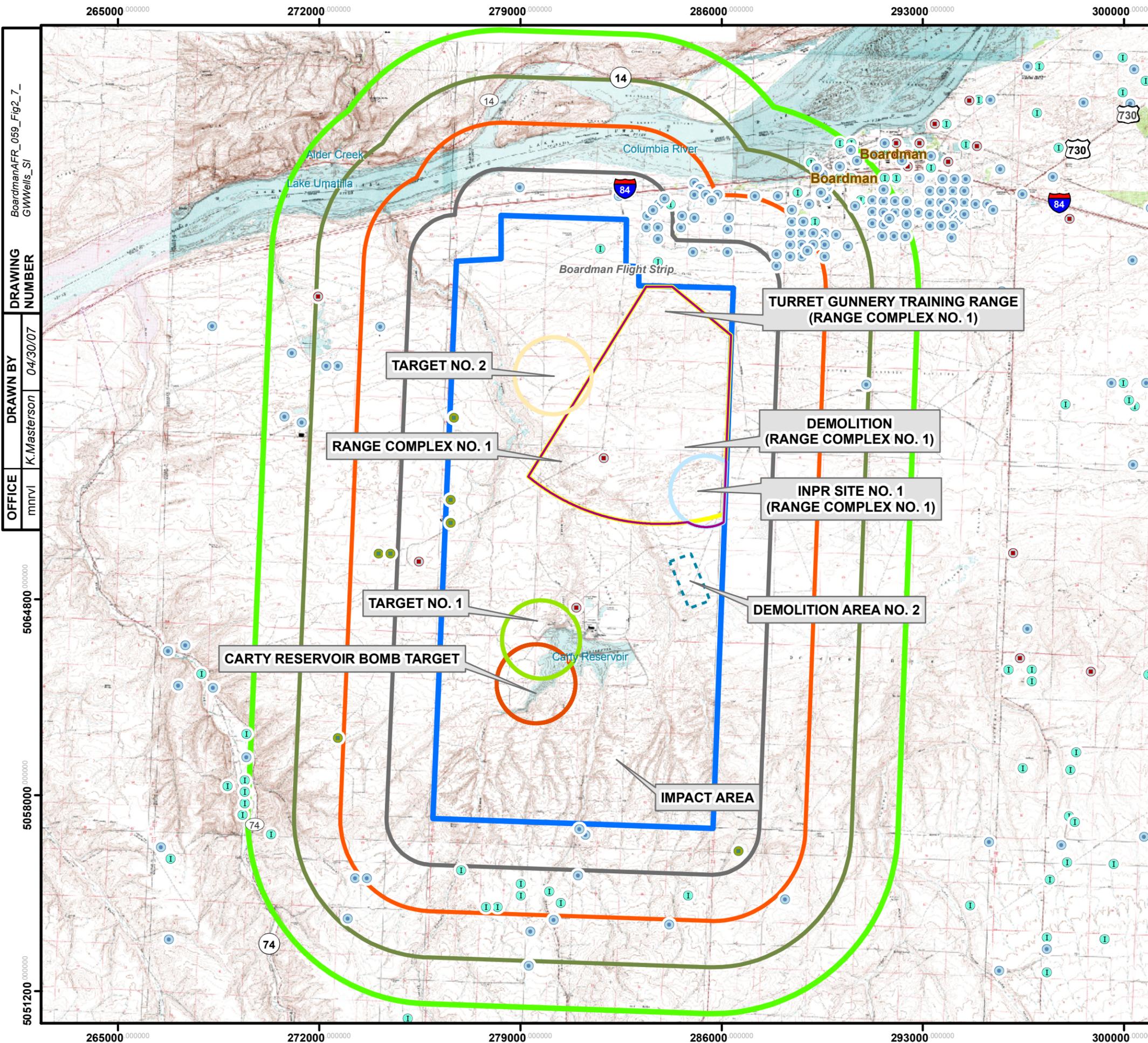
FIGURE 2-6

SENSITIVE RECEPTOR LOCATIONS

BOARDMAN AIR FORCE RANGE

Shaw Environmental, Inc.

272000 000000 279000 000000 286000 000000 293000 000000 300000 000000 307000 000000



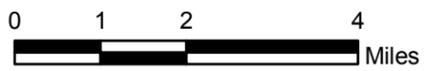
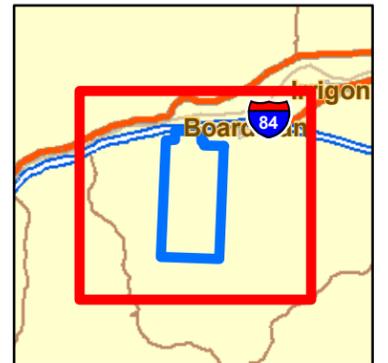
BoardmanAFR_059_Fig2_7_
 GWWells_SI
 DRAWING NUMBER
 DRAWN BY
 K.Masterson 04/30/07
 OFFICE
 mmv1

Legend

- Boardman Air Force Range FUDS Boundary
- 4-Mile Radius From Boardman Air Force Range FUDS Boundary
- 3-Mile Radius From Boardman Air Force Range FUDS Boundary
- 2-Mile Radius From Boardman Air Force Range FUDS Boundary
- 1-Mile Radius From Boardman Air Force Range FUDS Boundary
- Livestock Well
- Irrigation Well
- Industrial Well
- Public Well
- Domestic Well

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman Air Force Range ASR Supplement.
- 2) Groundwater well information obtained from the State of Oregon, Water Resources Department. Wells are plotted in the center of either the Township/Range/Section, Township/Range/Section/Quarter, or Township/Range/Section/Quarter/Quarter depending on available well data.
- 3) Topographic map (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.



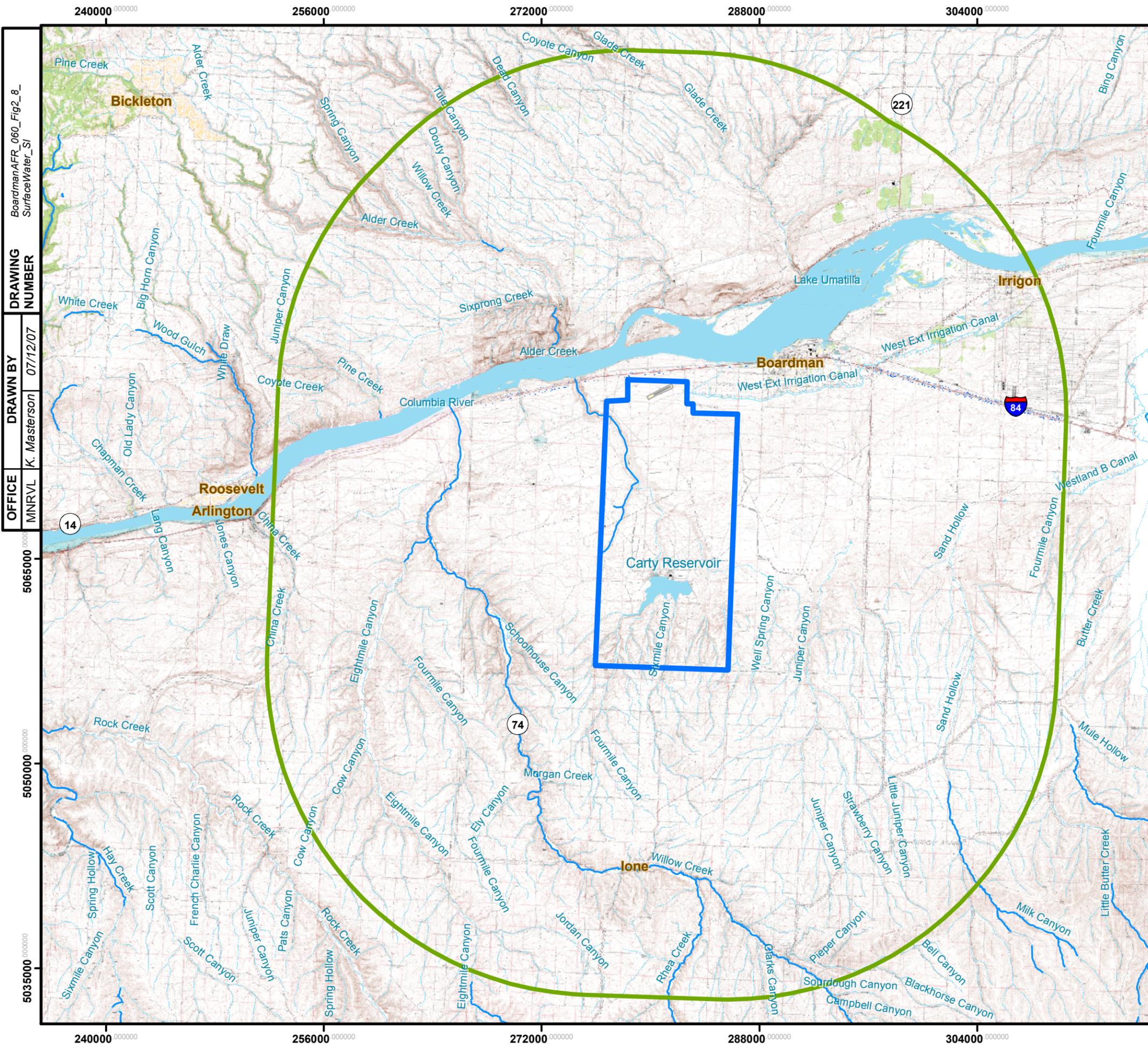
REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 2-7
GROUNDWATER WELL LOCATIONS

BOARDMAN AIR FORCE RANGE





BoardmanAFR_060_Fig2_8_
SurfaceWater_SI

DRAWING NUMBER

DRAWN BY

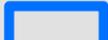
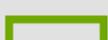
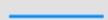
OFFICE

07/12/07

K. Masterson

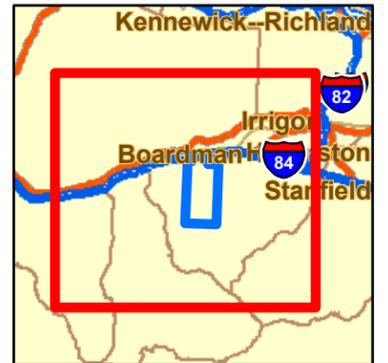
MNRVL

Legend

-  Boardman Air Force Range FUDS Boundary
-  15-Mile Radius From Boardman Air Force Range FUDS Boundary
-  Perennial stream or river
-  Intermittent stream, river, or wash
-  Intermittent canal, ditch, or aqueduct
-  Water Body

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Topographic maps (Morrow, Gilliam, Klickitat, and Benton Counties) were obtained from the U.S. Department of Agriculture, Service Center Agencies, 1999.



REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

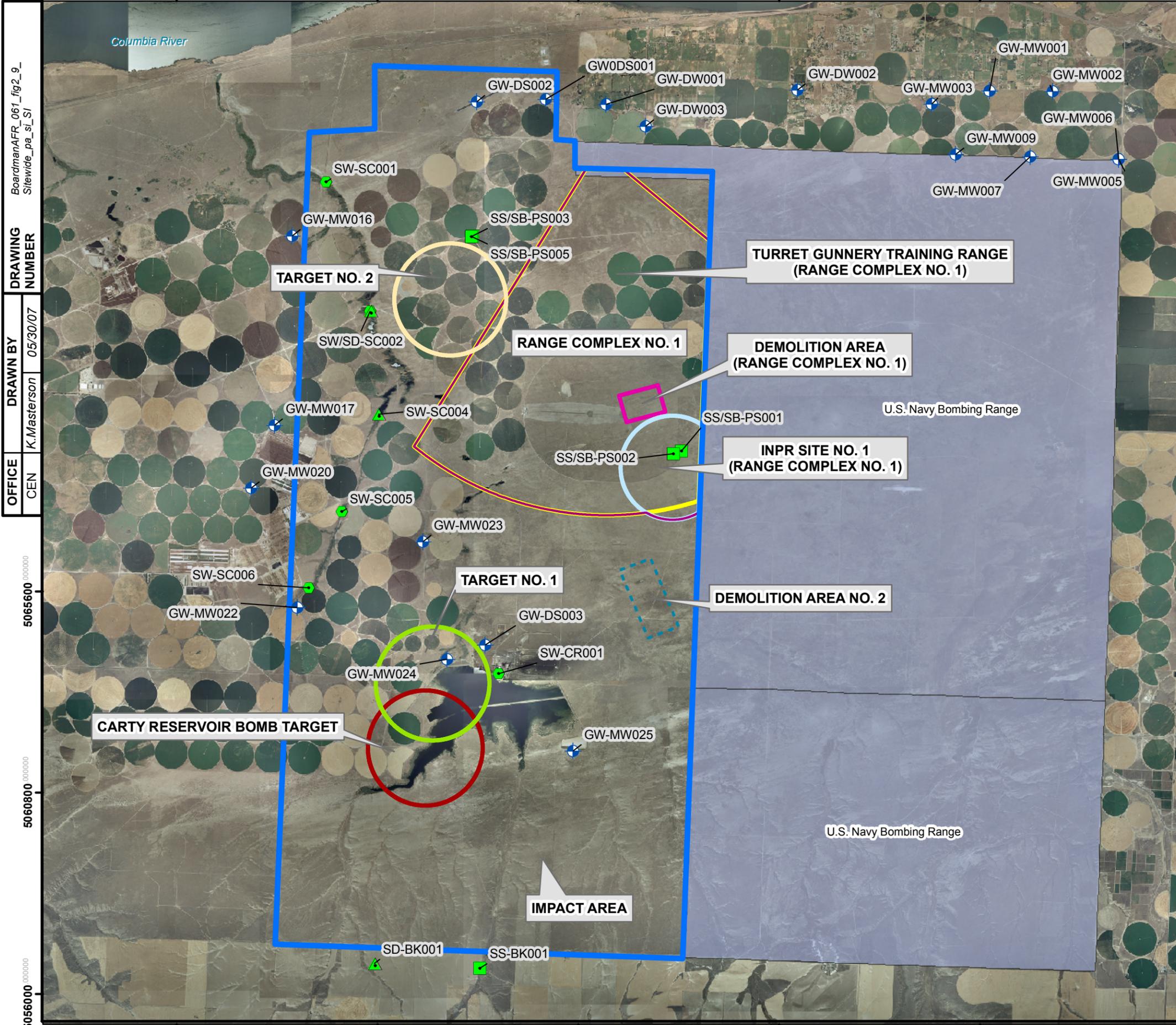
 U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 2-8
REGIONAL SURFACE WATER DRAINAGE

BOARDMAN AIR FORCE RANGE



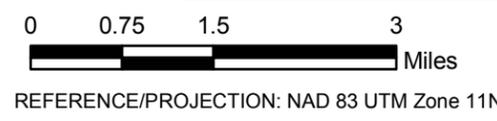
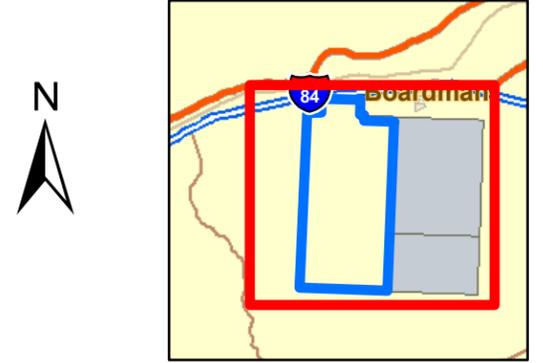
273600 000000 278400 000000 283200 000000 288000 000000 292800 000000 297600 000000



Legend

- Boardman Air Force Range FUDS Boundary
- Active U.S. Navy Bombing Range
- Ranges Included in the MMRP Range Inventory**
- Target No. 1
- Target No. 2
- Carty Reservoir Bomb Target
- Range Complex No. 1
- INPR Site No. 1 (Range Complex No. 1)
- Demolition Area (Range Complex No. 1)
- Turret Gunnery Training Range (Range Complex No. 1)
- Additional Areas Identified During Technical Planning**
- Demolition Area No. 2 (boundary not verified)
- Impact Area (boundary not defined)
- PA/SI Sample Location**
- Groundwater Sample
- Sediment Sample
- Soil Sample
- Surface Water Sample

NOTES:
 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



BoardmanAFR_061_fig2_9_SiteWide_pa_sl_SI
DRAWING NUMBER
 DRAWN BY: K. Masterson
 DATE: 05/30/07
OFFICE
 CEN

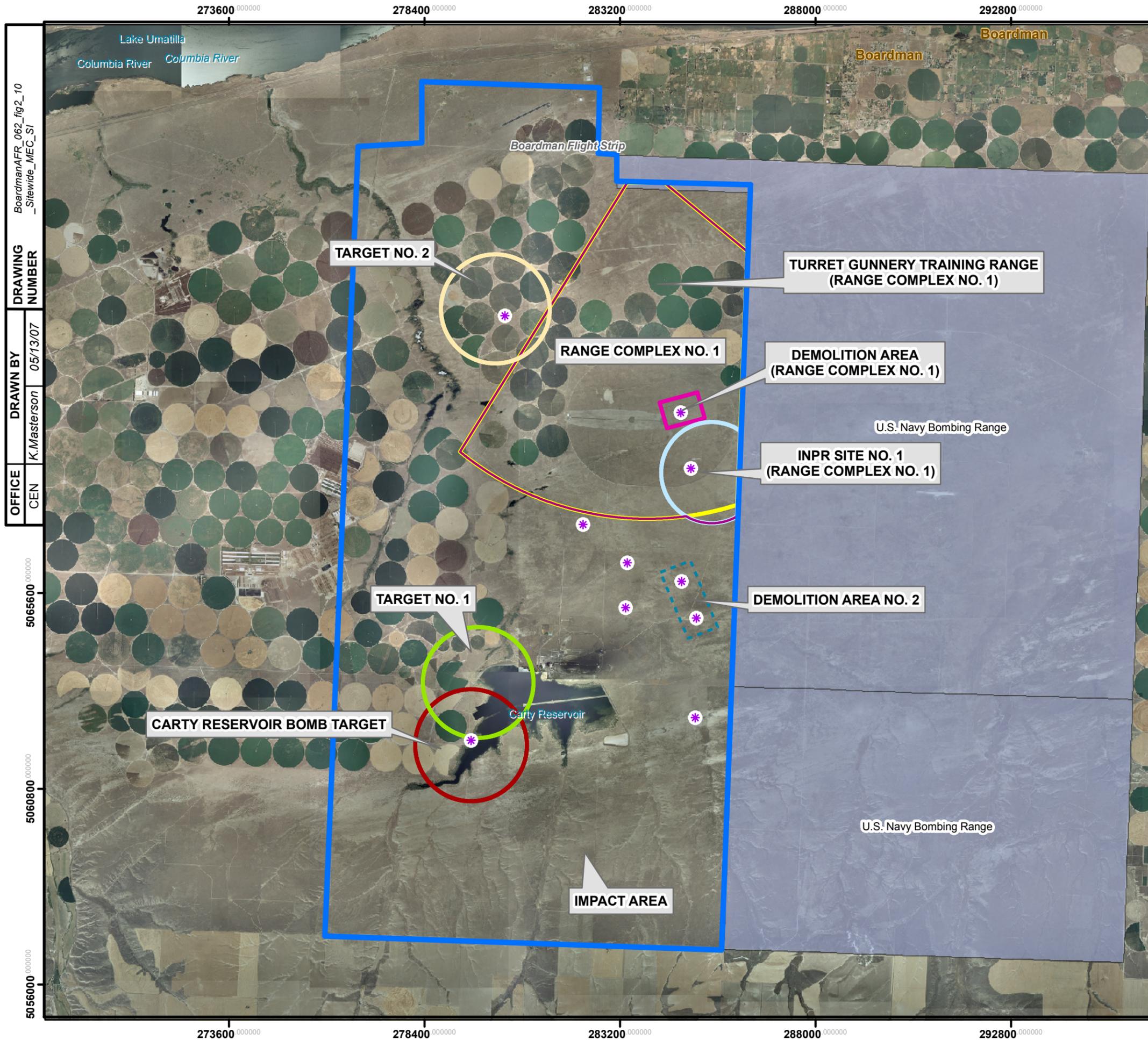
5065600 000000
 506800 000000
 506600 000000

U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 2-9
PA/SI SAMPLE LOCATIONS
 BOARDMAN AIR FORCE RANGE

Shaw Environmental, Inc.

273600 000000 278400 000000 283200 000000 288000 000000 292800 000000 297600 000000



Legend

- Boardman Air Force Range FUDS Boundary
- Active U.S. Navy Bombing Range
- Reported MEC Find

Ranges Included in the MMRP Range Inventory

- Target No. 1
- Target No. 2
- Carty Reservoir Bomb Target
- Range Complex No. 1
- INPR Site No. 1 (Range Complex No. 1)
- Demolition Area (Range Complex No. 1)
- Turret Gunnery Training Range (Range Complex No. 1)

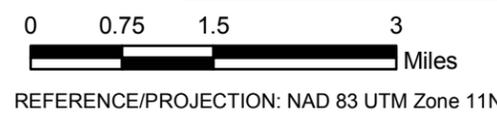
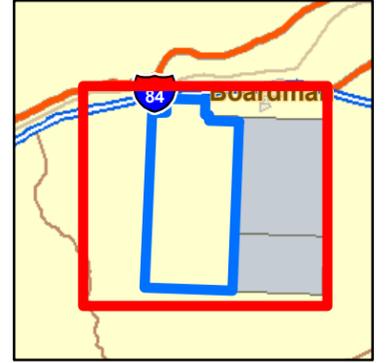
Additional Areas Identified During Technical Planning

- Demolition Area No. 2 (boundary not verified)
- Impact Area (boundary not defined)

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.
- 3) Reported MEC locations are from the 1997 ASR.

5075200 5070400 5065600 5060800 5056000



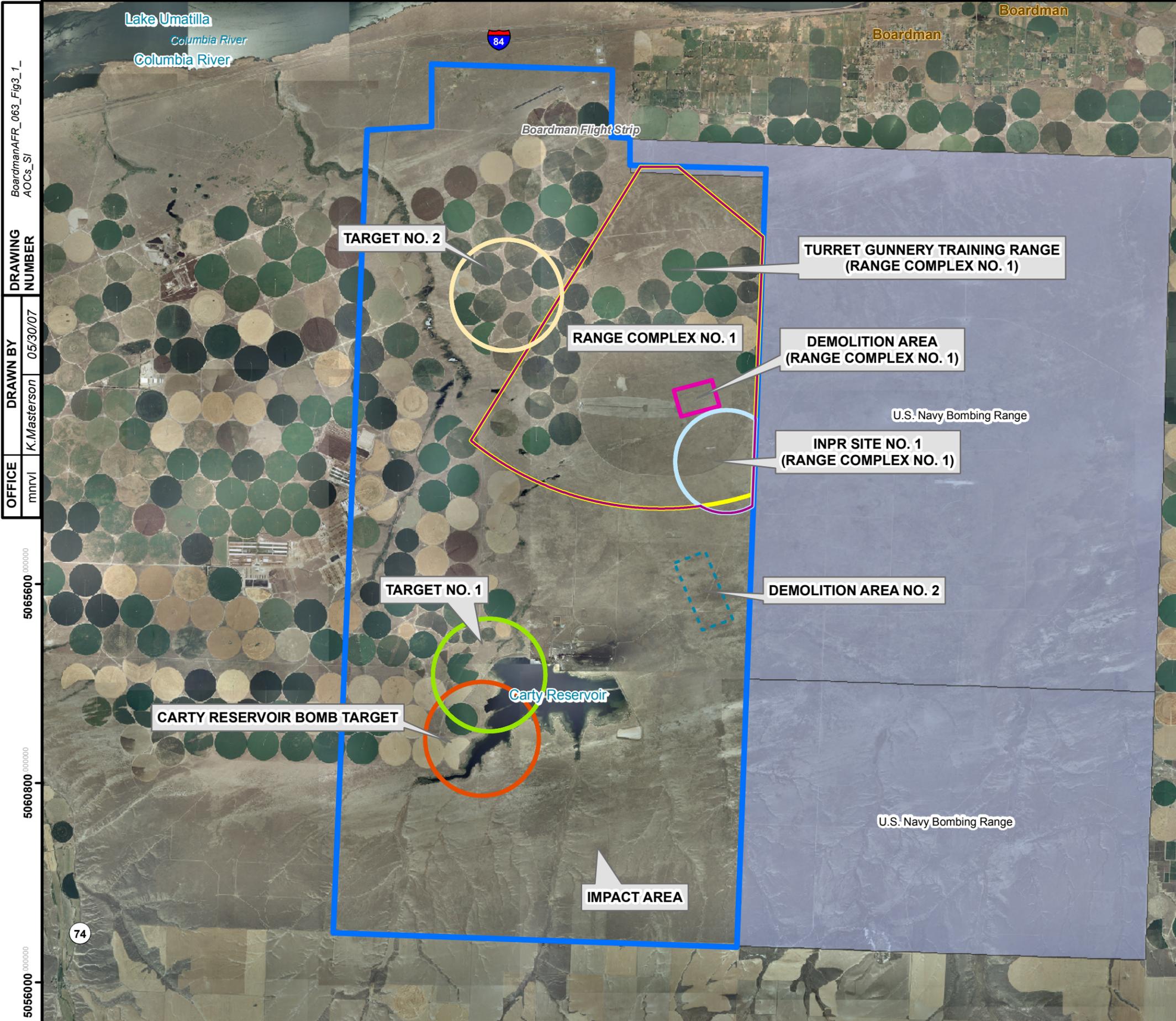
DRAWING NUMBER: BoardmanAFR_062_fig2_10_SiteWide_MEC_SI
 DRAWN BY: K.Masterson
 DATE: 05/13/07
 OFFICE: CEN

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FIGURE 2-10
REPORTED MEC FINDS
FROM 1997 ASR
 BOARDMAN AIR FORCE RANGE

Shaw Environmental, Inc.

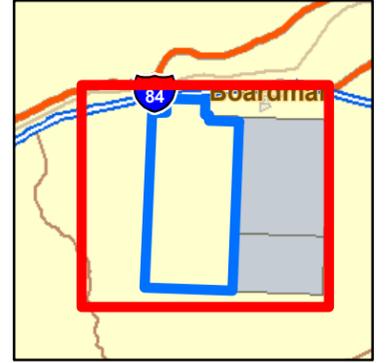
273600.000000 278400.000000 283200.000000 288000.000000 292800.000000



Legend

- Boardman Air Force Range FUDS Boundary
- Active U.S. Navy Bombing Range
- Boardman Air Force Range Areas of Concern**
- Target No. 1
- Target No. 2
- Carty Reservoir Bomb Target
- Range Complex No. 1
- INPR Site No. 1 (Range Complex No. 1)
- Demolition (Range Complex No. 1)
- Turret Gunnery Training Range (Range Complex No. 1)
- Additional Areas Identified During Technical Planning**
- Demolition Area No. 2 (boundary not verified)
- Impact Area (boundary not defined)

NOTES:
 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



REFERENCE/PROJECTION: NAD 83 UTM Zone 11N



U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 3-1
SITE INSPECTION
AREAS OF CONCERN

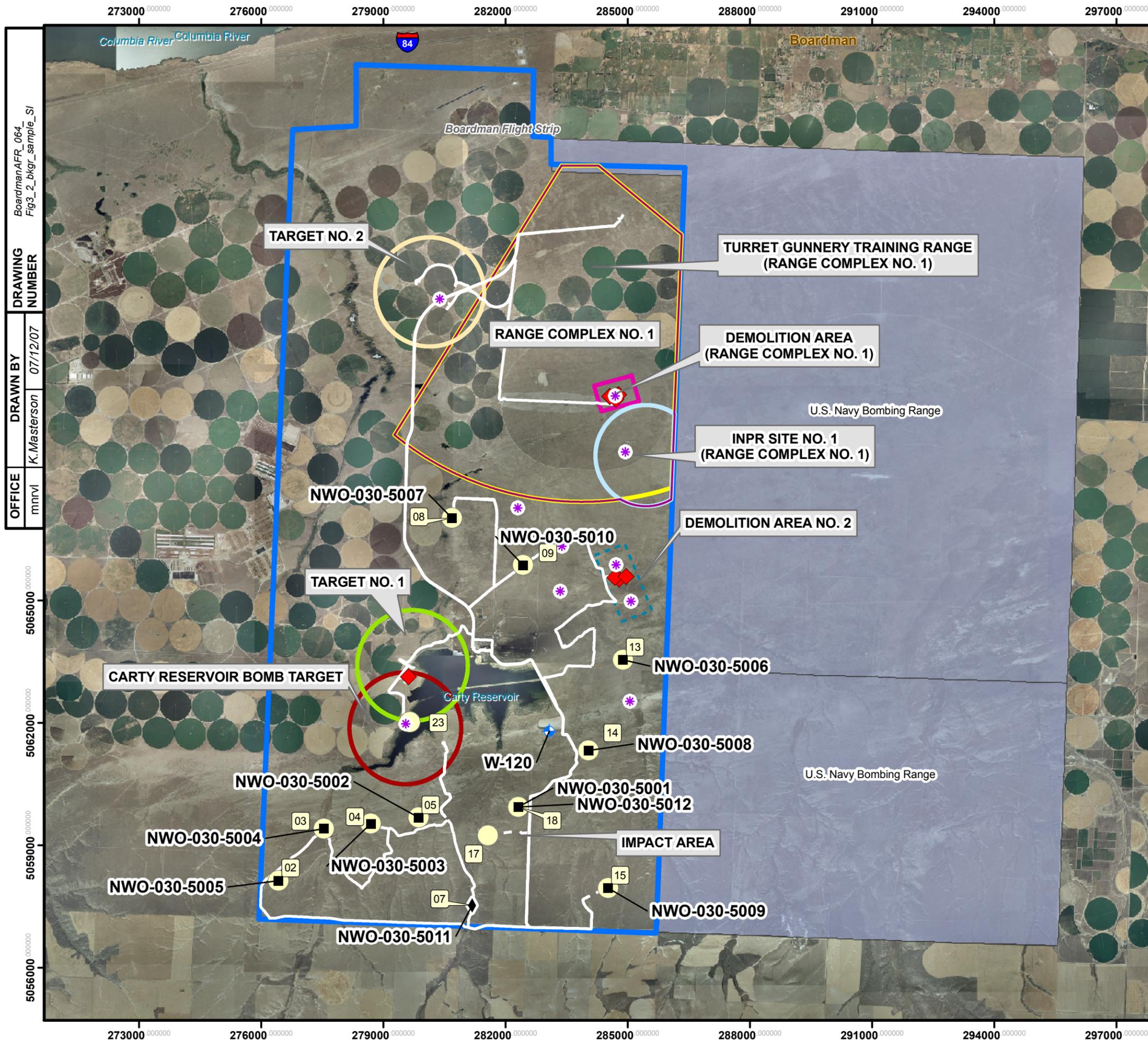
BOARDMAN AIR FORCE RANGE



BoardmanAFR_063_Fig3_1_ AOCs_SI
 DRAWING NUMBER
 DRAWN BY K.Masterson 05/30/07
 OFFICE mnrvl

5075200.000000
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 5065600.000000
 5060800.000000
 5056000.000000

273600.000000 278400.000000 283200.000000 288000.000000 292800.000000



Legend

- Boardman Air Force Range FUDS Boundary
- Active U.S. Navy Bombing Range
- Ranges Included in the MMRP Range Inventory**
- Target No. 1
- Target No. 2
- Carty Reservoir Bomb Target
- Range Complex No. 1
- INPR Site No. 1 (Range Complex No. 1)
- Demolition Area (Range Complex No. 1)
- Turret Gunnery Training Range (Range Complex No. 1)
- Additional Areas Identified During Technical Planning**
- Demolition Area No. 2 (boundary not verified)
- Impact Area (boundary not defined)
- Reported MEC Find
- Background Soil Sample
- Background Sediment Sample
- Munitions Debris
- Photograph Location
- Background Groundwater Well
- Reconnaissance Path Walked (2/27/07)
- Reconnaissance Path Driven (2/27/07)

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.

N

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

U.S. ARMY CORPS OF ENGINEERS
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FIGURE 3-2
BACKGROUND SAMPLE LOCATIONS
AND RECONNAISSANCE
BOARDMAN AIR FORCE RANGE

Shaw Environmental, Inc.

BoardmanAFR_064
Fig3_2_bkgf_sample_SI

DRAWING NUMBER

DRAWN BY
K. Masterson 07/12/07

OFFICE
mrvl

277600 000000 278400 000000 279200 000000 280000 000000 280800 000000 281600 000000



BoardmanAFR_065_Fig4_1_trg1_
CartyResv_Recon_Sl

DRAWING NUMBER
DRAWN BY
OFFICE

5062400 000000
5061600 000000
5060800 000000

Legend

- Boardman Air Force Range FUDS Boundary
- Boardman Air Force Range Areas of Concern
- Target No. 1
- Carty Reservoir Bomb Target
- Reported MEC Find
- Reconnaissance Path Walked
- Reconnaissance Path Driven
- Munitions Debris
- Sediment Sample
- Soil Sample
- Photograph Location

PA/SI Sample Locations

- Groundwater Sample
- Surface Water Sample

NOTES:

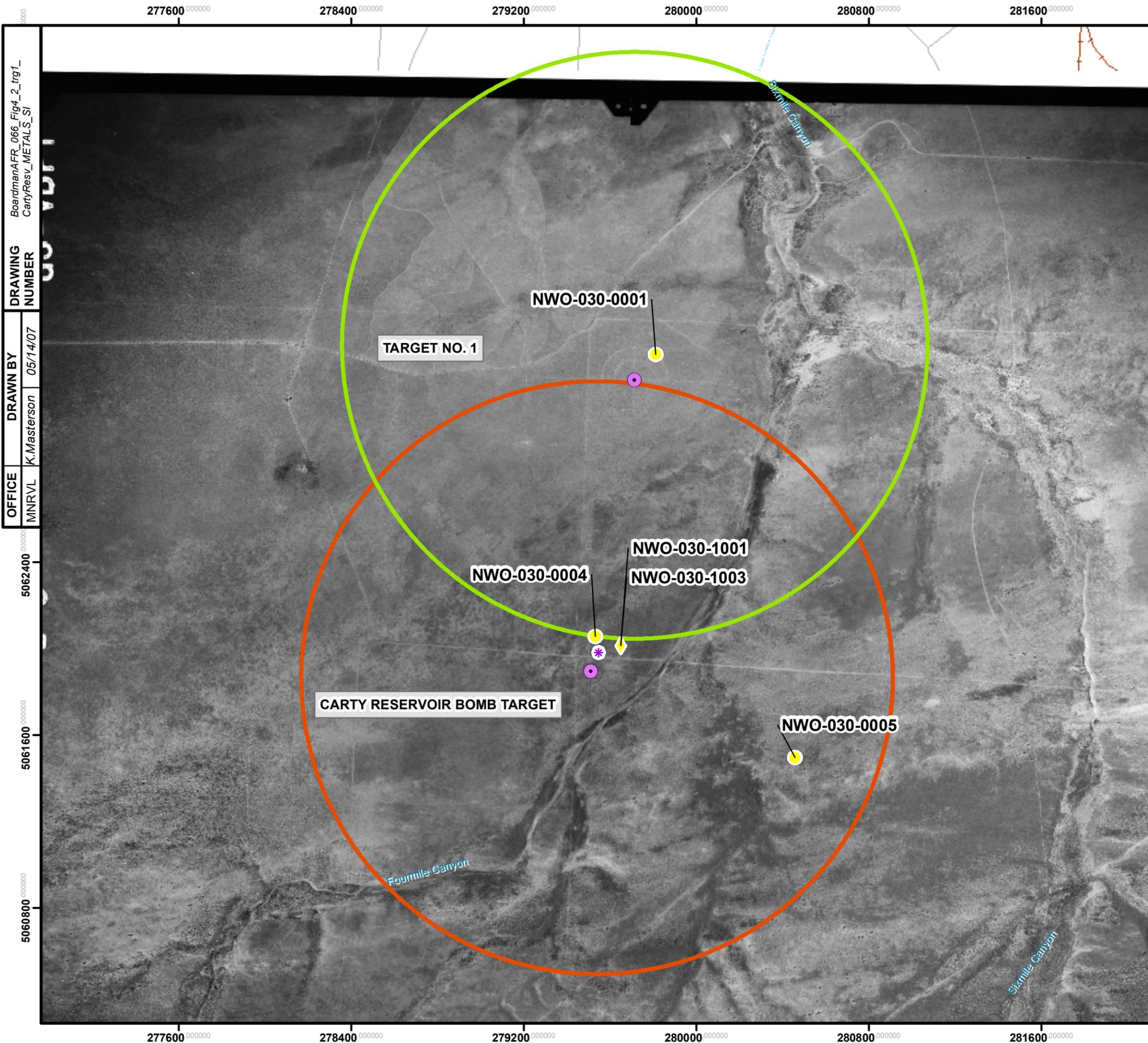
- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

U.S. ARMY CORPS OF ENGINEERS
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FIGURE 4-1
TARGET NO. 1 AND CARTY RESERVOIR BOMB TARGET RECONNAISSANCE
BOARDMAN AIR FORCE RANGE

Shaw Environmental, Inc.



BoardmanAFR_066_Fig4_2_trg1_
 CartyResy_METALS_SI
DRAWING NUMBER
 DRAWN BY
 K.Masterson
 05/14/07
OFFICE
 MNRVL
 5062400.000000
 5061600.000000
 5060800.000000

Legend

- Boardman Air Force Range FUDS Boundary
- Boardman Air Force Range Areas of Concern
- Target No. 1
- Carty Reservoir Bomb Target
- * Reported MEC Find
- Bomb Target Center
- ◆ Sediment Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels
- Soil Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

NOTES:
 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
 2) Aerial photo was obtained from the U.S.G.S. and is dated September 1, 1965.

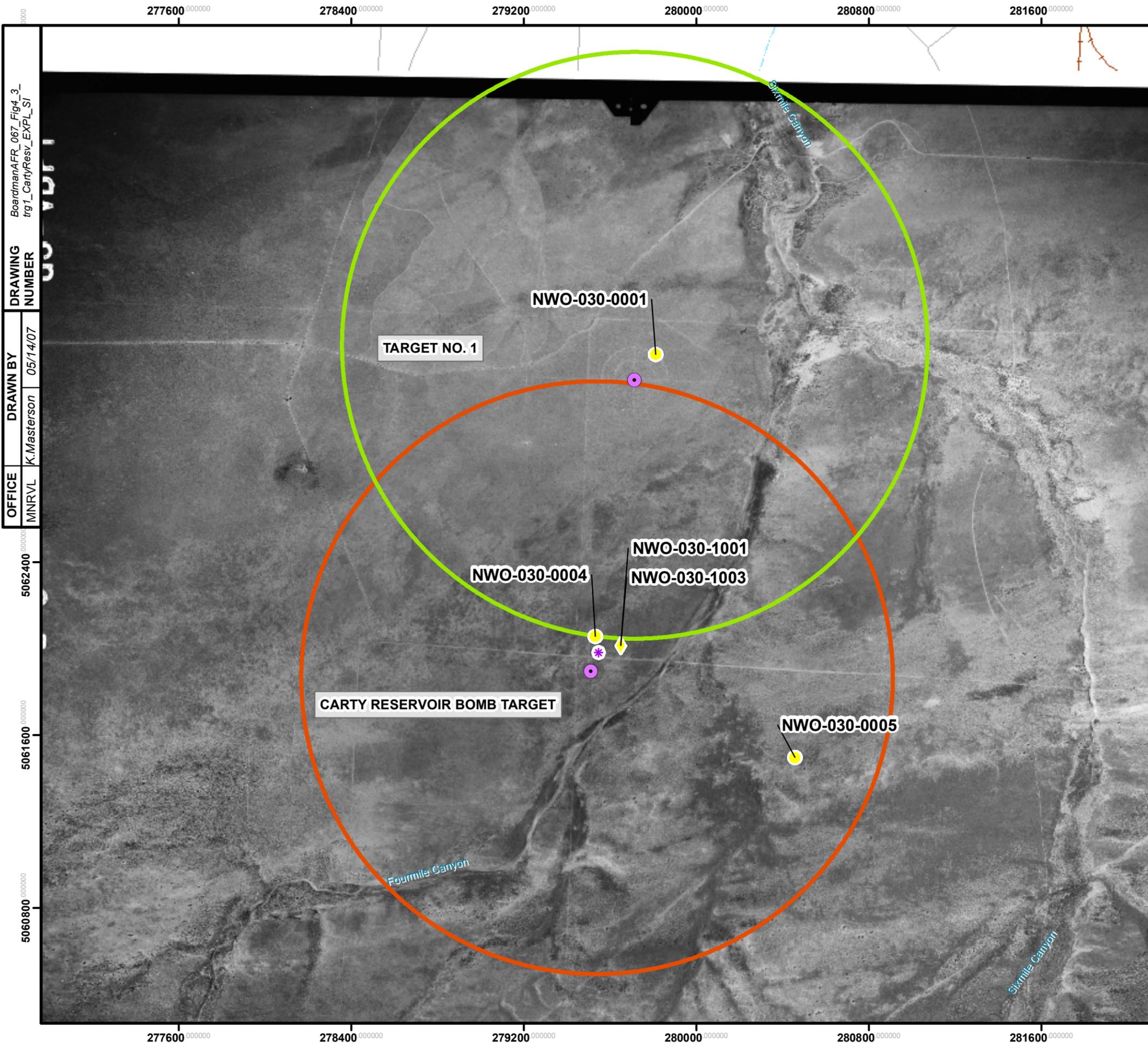
N

0 750 1,500 3,000
Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 4-2
TARGET NO. 1 AND CARTY RESERVOIR BOMB TARGET SAMPLE LOCATIONS AND METALS RESULTS
 BOARDMAN AIR FORCE RANGE



BoardmanAFR_067_Fig4_3_trg1_CartyResv_EXPL_SI_1
 DRAWING NUMBER
 DRAWN BY K.Masterson 05/14/07
 OFFICE MNRVL
 5062400
 5061600
 5060800

Legend

- Boardman Air Force Range FUDS Boundary
- Boardman Air Force Range Areas of Concern
- Target No. 1
- Carty Reservoir Bomb Target
- * Reported MEC Find
- Bomb Target Center
- ◆ Sediment Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels
- Soil Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

NOTES:
 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
 2) Aerial photo was obtained from the U.S.G.S. and is dated September 1, 1965.

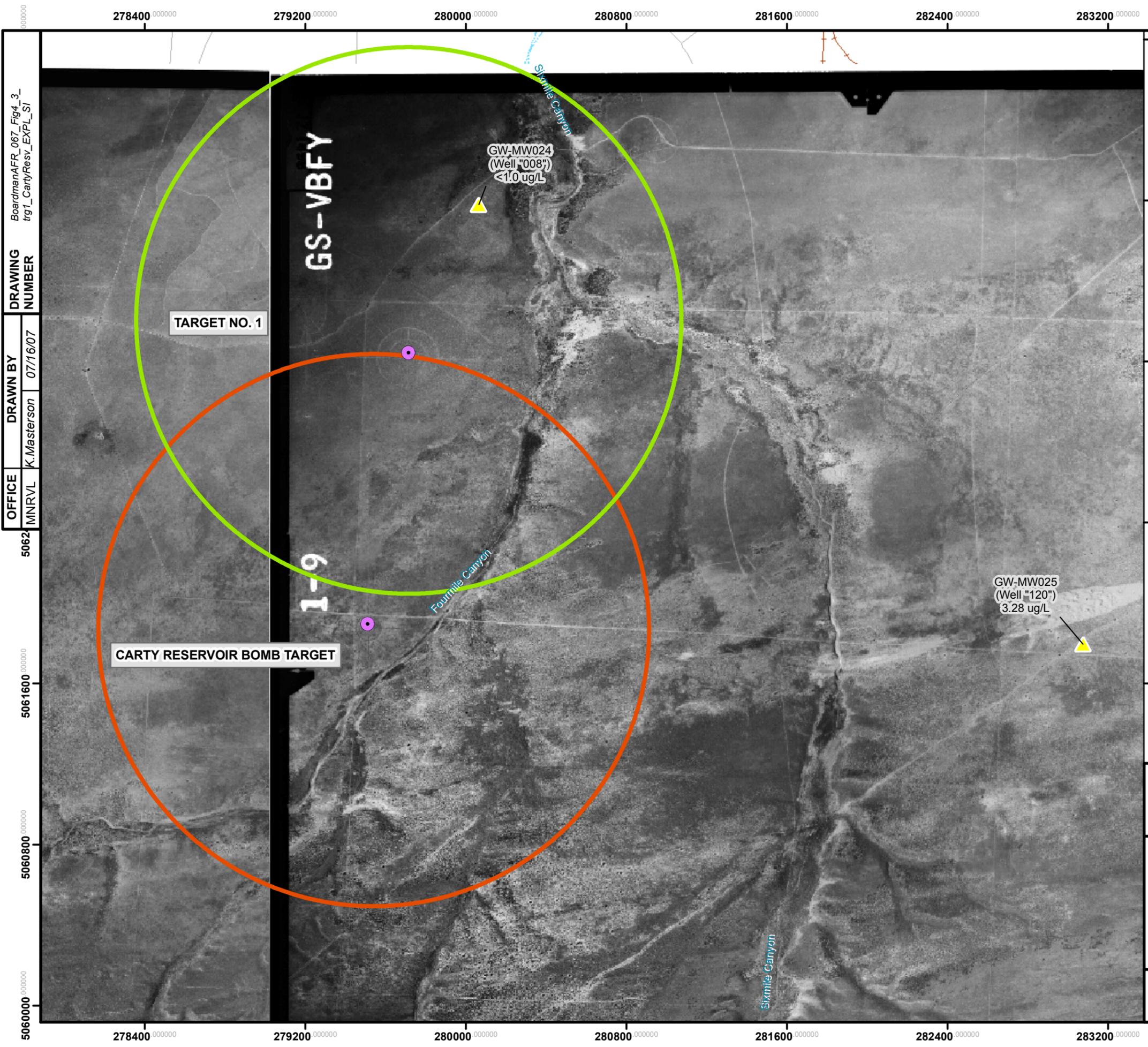
N

0 750 1,500 3,000 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 4-3
TARGET NO. 1 AND CARTY RESERVOIR BOMB TARGET SAMPLE LOCATIONS AND EXPLOSIVES RESULTS
 BOARDMAN AIR FORCE RANGE



BOARDMAN AFR 067 Fig 4.3 - trg1_Carty/Resv_EXP_L_S1
 DRAWING NUMBER
 DRAWN BY
 OFFICE
 MNRVL
 K. Masterson
 07/16/07
 5062
 5061600
 5060800
 5060000

Legend

- Boardman Air Force Range FUDS Boundary
- Boardman Air Force Range Areas of Concern
- Target No. 1
- Carty Reservoir Bomb Target
- Bomb Target Center
- ▲ Groundwater Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels
- ▲ 3.28 ug/L – Perchlorate concentration in micrograms per liter

NOTES:
 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
 2) Aerial photo was obtained from the U.S.G.S. and is dated September 1, 1965.

N

0 800 1,600 3,200 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

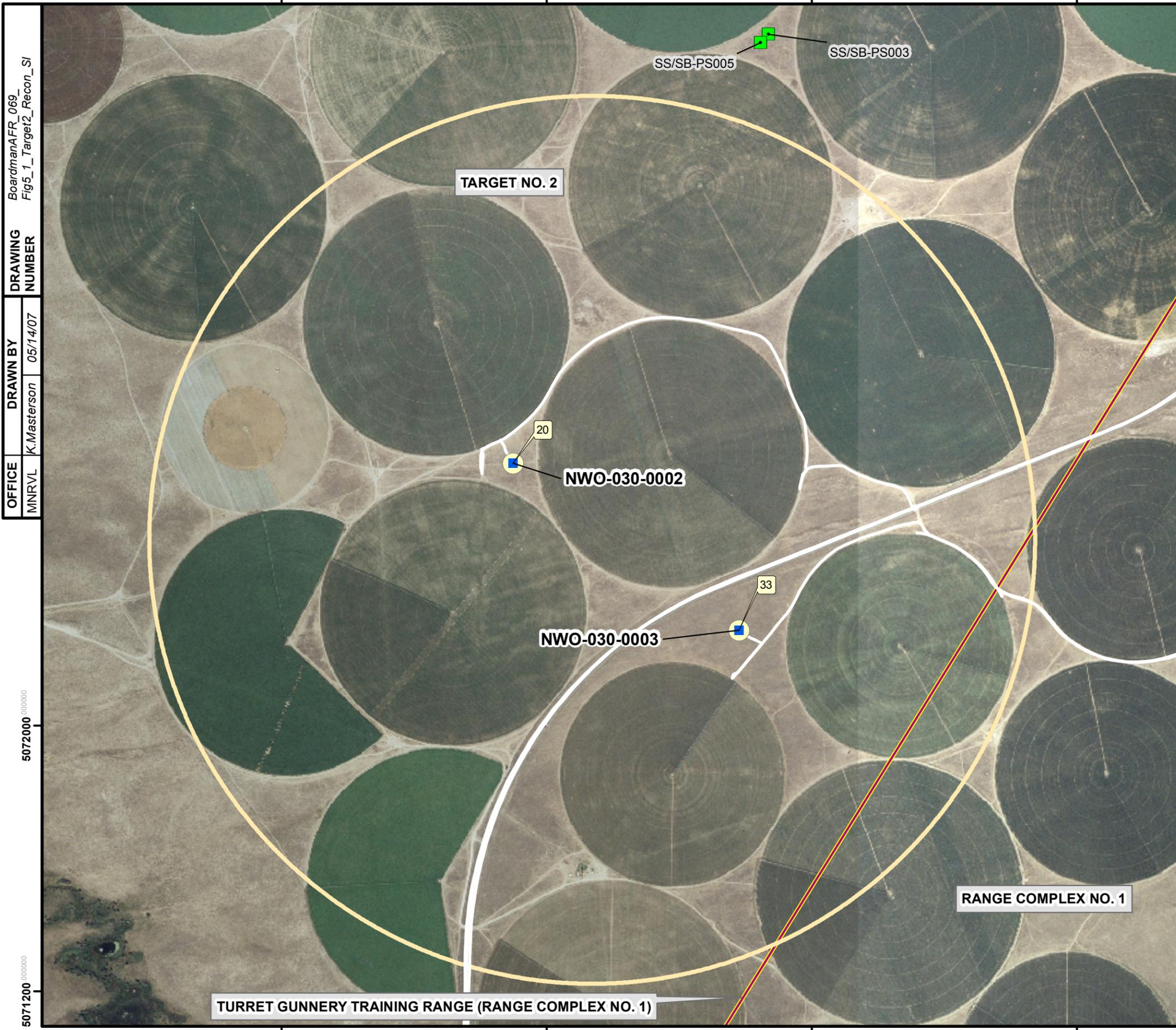
U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 4-4

TARGET NO. 1 AND CARTY RESERVOIR BOMB TARGET PA/SI GROUNDWATER SAMPLE RESULTS

BOARDMAN AIR FORCE RANGE

279200 280000 280800 281600



BoardmanAFR_069_ Fig5_1_Target2_Recon_SI
 DRAWING NUMBER
 DRAWN BY
 OFFICE
 MNRVL
 K.Masterson
 05/14/07

Legend

- Boardman Air Force Range FUDS Boundary
- Boardman Air Force Range Areas of Concern**
- Target No. 2
- Range Complex No. 1
- Turret Gunnery Training Range (Range Complex No. 1)
- Reconnaissance Path Walked
- Reconnaissance Path Driven
- Soil Sample
- Photograph Location
- PA/SI Sample Location**
- Soil Sample

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.

0 500 1,000 2,000 Feet
 REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

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 OMAHA DESIGN CENTER

FIGURE 5-1
TARGET NO. 2 RECONNAISSANCE
 BOARDMAN AIR FORCE RANGE

Shaw Environmental, Inc.

5072000
 5072800
 5073600
 5071200

279200 280000 280800 281600

279200 000000

280000 000000

280800 000000

281600 000000

BoardmanAFR_070_ Fig5.2_Target2_Recon_SI

DRAWING NUMBER
DRAWN BY
K.Masterson 05/01/07

OFFICE
MNRVL

5072000 000000

5071200 000000

SS/SB-PS005

SS/SB-PS003

TARGET NO. 2

NWO-030-0002

NWO-030-0003

RANGE COMPLEX NO. 1

TURRET GUNNERY TRAINING RANGE (RANGE COMPLEX NO. 1)

Legend

-  Boardman Air Force Range FUDS Boundary
- Boardman Air Force Range Areas of Concern**
-  Target No. 2
-  Range Complex No. 1
-  Turret Gunnery Training Range (Range Complex No. 1)
-  Soil Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

NOTES:

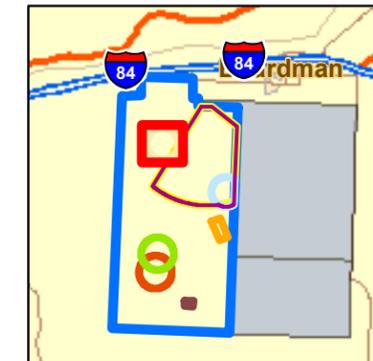
- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo was obtained from the U.S.G.S. and is dated October 21, 1958.

5073600 000000

5072800 000000

5072000 000000

5071200 000000



0 500 1,000 2,000 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N



U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

**FIGURE 5-2
TARGET NO. 2 SAMPLE LOCATIONS
AND METALS RESULTS**

BOARDMAN AIR FORCE RANGE

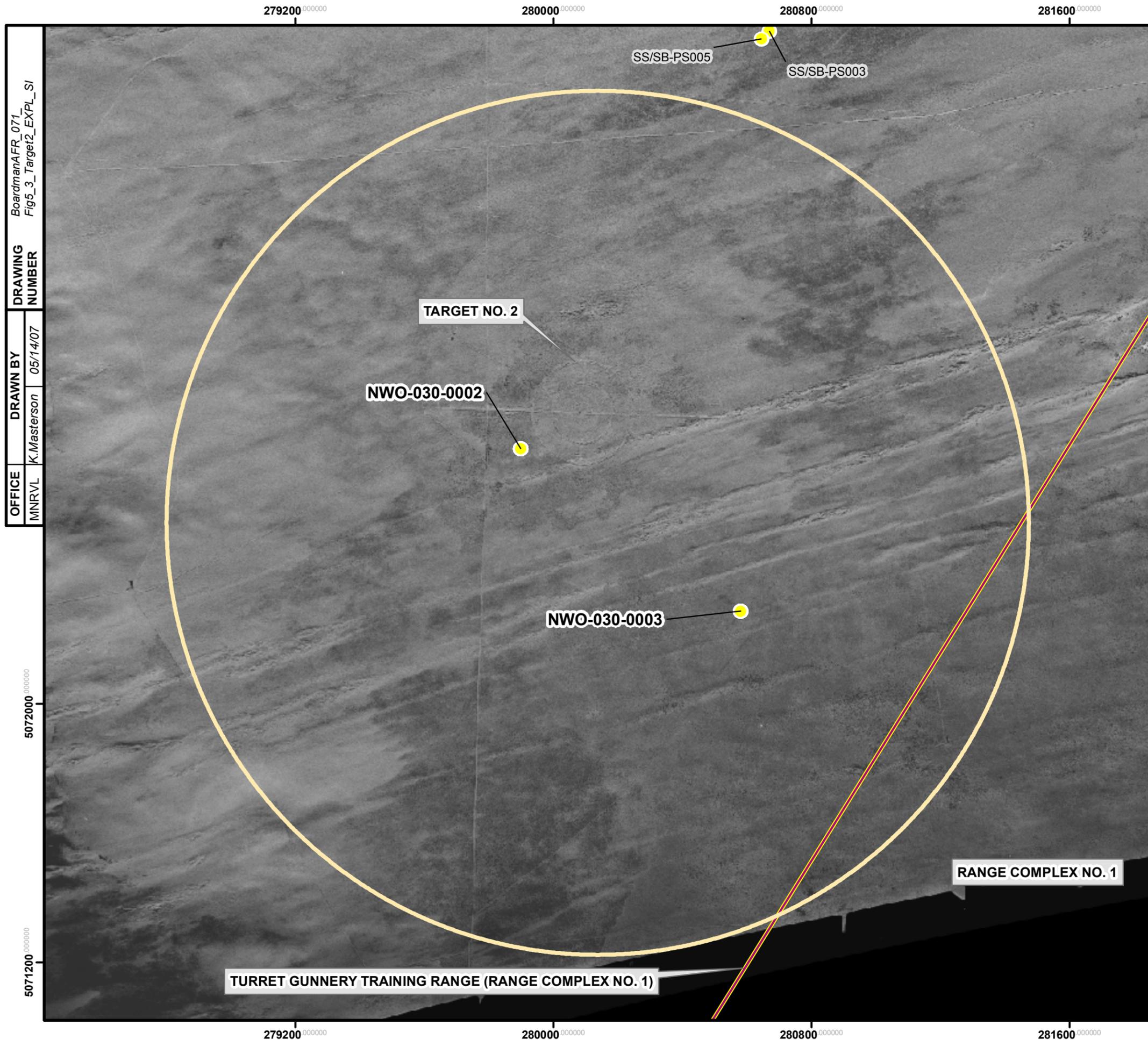


279200 000000

280000 000000

280800 000000

281600 000000



OFFICE: MNRVL
 DRAWN BY: K. Masterson
 DRAWING NUMBER: BoardmanAFR_071_ Fig5_3_Target2_EXPL_SI
 DATE: 05/14/07

5072000
 5071200

279200 280000 280800 281600

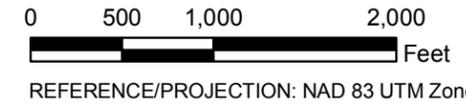
279200 280000 280800 281600

Legend

- Boardman Air Force Range FUDS Boundary
- Boardman Air Force Range Areas of Concern**
- Target No. 2
- Range Complex No. 1
- Turret Gunnery Training Range (Range Complex No. 1)
- Soil Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

NOTES:

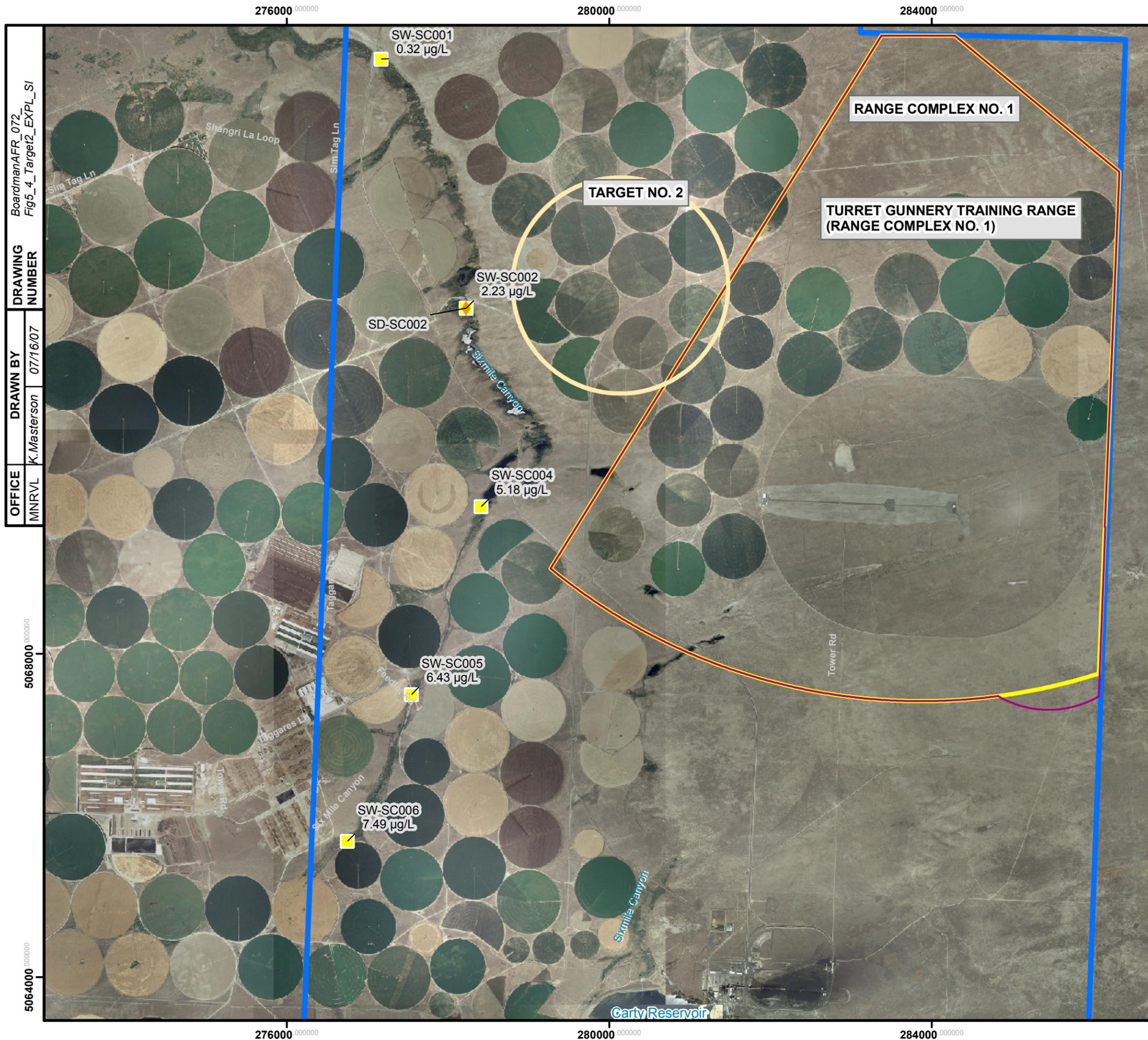
- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo was obtained from the U.S.G.S. and is dated October 21, 1958.



U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 5-3
TARGET NO. 2 SAMPLE LOCATIONS
AND EXPLOSIVES RESULTS
 BOARDMAN AIR FORCE RANGE





BoardmanAFR_072_ Fig5_4_Target2_EXPL_SI
 DRAWING NUMBER
 DRAWN BY K. Masterson 07/16/07
 OFFICE MNRVL

5068000
 5064000

276000 280000 284000

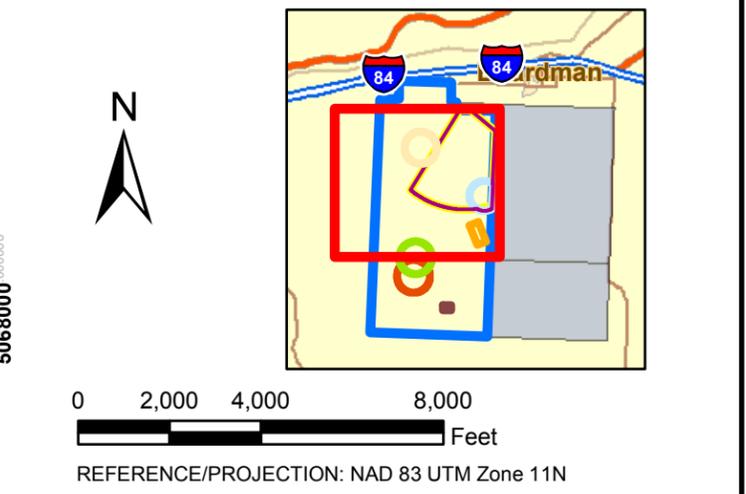
276000 280000 284000

Legend

- Boardman Air Force Range FUDS Boundary
- Boardman Air Force Range Areas of Concern
 - Target No. 2
 - Range Complex No. 1
 - Turret Gunnery Training Range (Range Complex No. 1)
- PA/SI Sample Locations
 - Surface Water Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels
 - Sediment Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

µg/L Micrograms per Liter

NOTES:
 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
 2) Aerial photo was obtained from the U.S.D.A. and dated 2005.

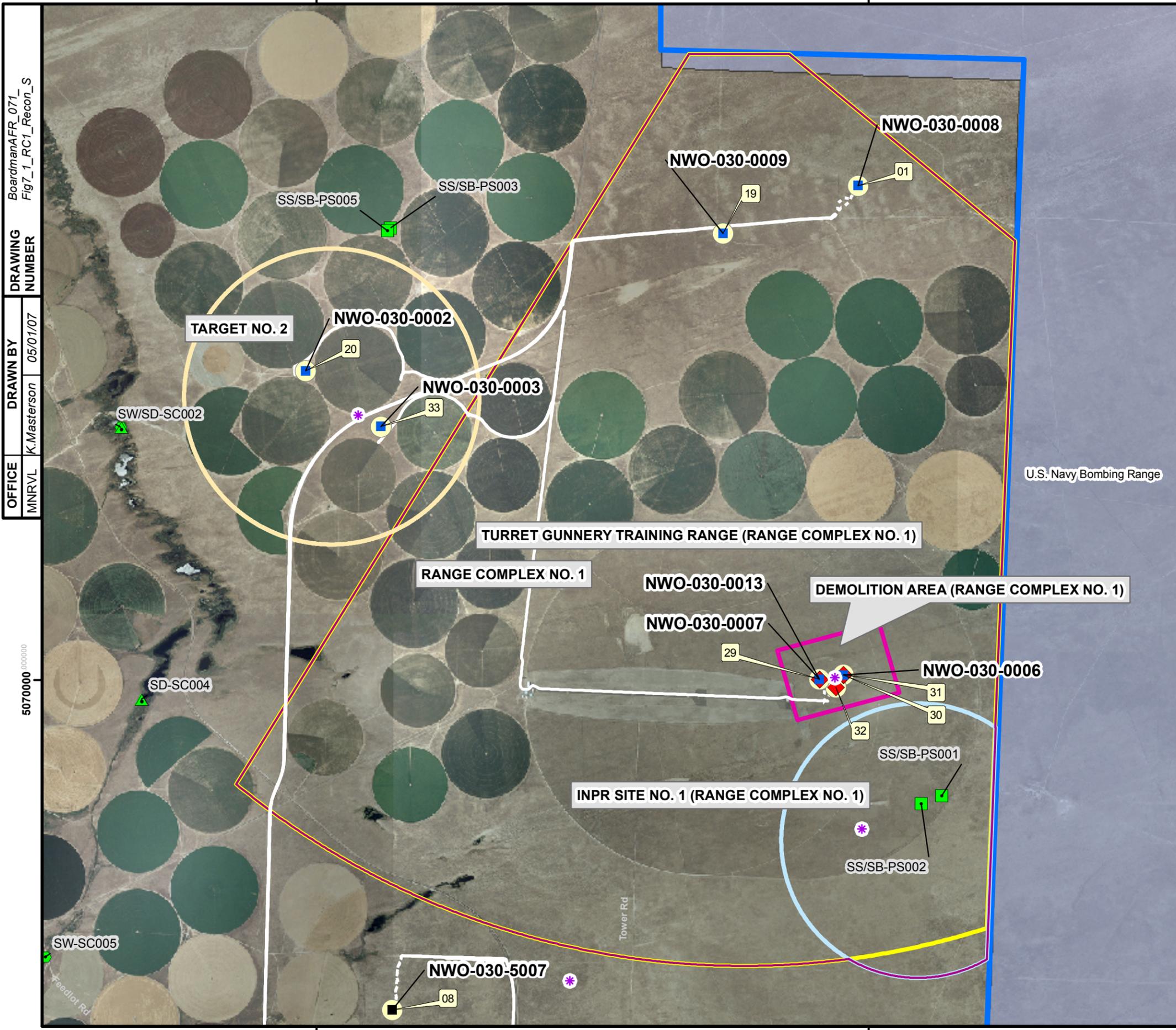


 U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 5-4
TARGET NO. 2
PA/SI SURFACE WATER PERCHLORATE
AND SEDIMENT METALS SAMPLING RESULTS
 BOARDMAN AIR FORCE RANGE

280000 000000

285000 000000

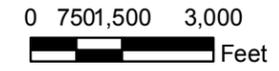


Legend

- Boardman Air Force Range FUDS Boundary
- Active U.S. Navy Bombing Range
- Ranges Included in the MMRP Range Inventory**
- Target No. 2
- Range Complex No. 1
- INPR Site No. 1 (Range Complex No. 1)
- Demolition Area (Range Complex No. 1)
- Turret Gunnery Training Range (Range Complex No. 1)
- Reconnaissance Path Walked
- Reconnaissance Path Driven
- ◆ Munitions Debris
- Background Soil Sample
- Soil Sample
- Photograph Location
- ✱ Reported MEC Find
- PA/SI Sample Location**
- ▲ Sediment Sample
- Soil Sample
- Surface Water Sample

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

BOARDMAN AFR_071_ Fig7_1_RC1_Recon_S
 DRAWING NUMBER
 DRAWN BY K.Masterson 05/01/07
 OFFICE MINRVL

U.S. ARMY CORPS OF ENGINEERS
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FIGURE 7-1
RANGE COMPLEX NO. 1
RECONNAISSANCE
 BOARDMAN AIR FORCE RANGE



280000 000000

285000 000000

5075000 000000

5070000 000000

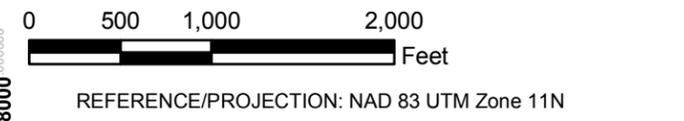
284000.000000 285000.000000 286000.000000



Legend

- Boardman Air Force Range FUDS Boundary
- Active U.S. Navy Bombing Range
- Ranges Included in the MMRP Range Inventory**
- Target No. 2
- Range Complex No. 1
- INPR Site No. 1 (Range Complex No. 1)
- Demolition Area (Range Complex No. 1)
- Turret Gunnery Training Range (Range Complex No. 1)
- Reported MEC Find
- Munitions Debris
- Soil Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

NOTES:
 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
 2) Aerial photo was obtained from the U.S.G.S. and is dated September 20, 1965.



BoardmanAFR_074
 Fig7_2_INPR_METALS_SI
DRAWING NUMBER
 DRAWN BY
 K.Masterson 05/14/07
OFFICE
 MNRVL

U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 7-2
INPR SITE NO. 1
RANGE COMPLEX NO. 1
SAMPLE LOCATIONS AND METALS RESULTS
 BOARDMAN AIR FORCE RANGE

284000.000000 285000.000000 286000.000000

5068000.000000

5069000.000000

5070000.000000

284000.000000 285000.000000 286000.000000



BoardmanAFR_075
Fig7_3_INPR_EXPL_SI

DRAWING NUMBER

DRAWN BY K.Masterson 05/14/07

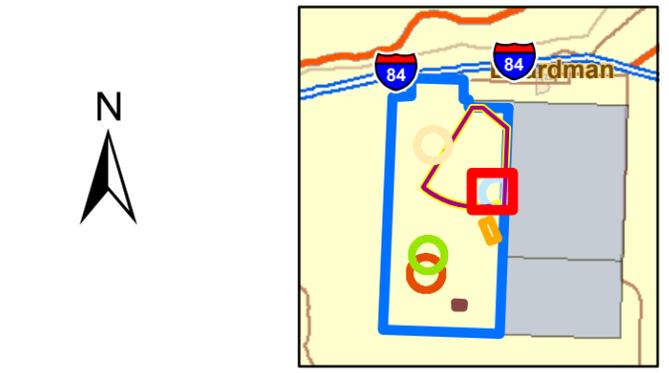
OFFICE MNRVL

Legend

- Boardman Air Force Range FUDS Boundary
- Active U.S. Navy Bombing Range
- Ranges Included in the MMRP Range Inventory**
- Target No. 2
- Range Complex No. 1
- INPR Site No. 1 (Range Complex No. 1)
- Demolition Area (Range Complex No. 1)
- Turret Gunnery Training Range (Range Complex No. 1)
- Reported MEC Find
- Munitions Debris
- Soil Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo was obtained from the U.S.G.S. and is dated September 20, 1965.



0 500 1,000 2,000 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 7-3
INPR SITE NO. 1
RANGE COMPLEX NO. 1
SAMPLE LOCATIONS
AND EXPLOSIVES RESULTS
BOARDMAN AIR FORCE RANGE

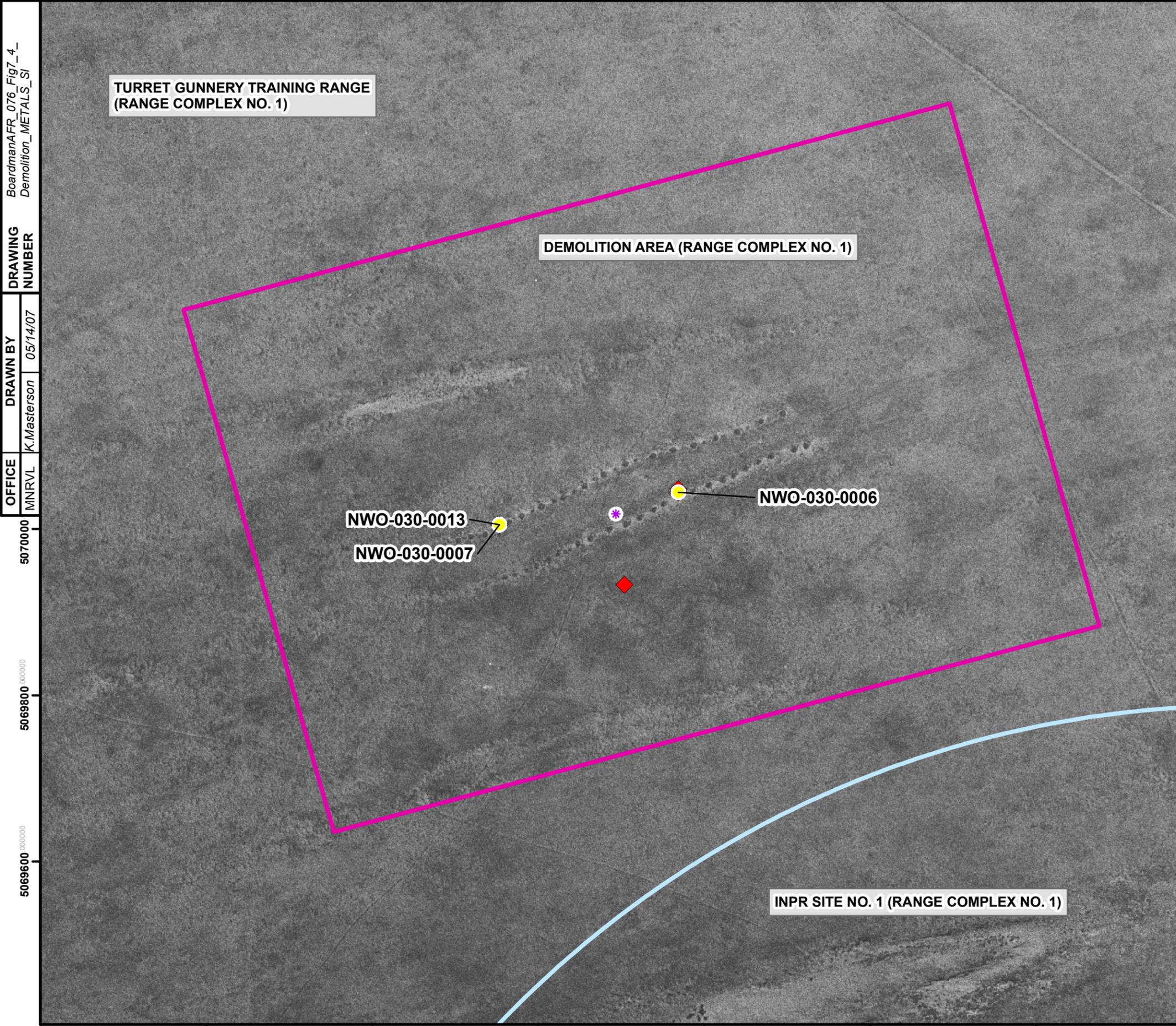
284000.000000 285000.000000 286000.000000

5068000.000000

5069000.000000

5070000.000000

284000 284200 284400 284600 284800 285000 285200



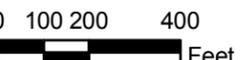
Legend

-  Boardman Air Force Range FUDS Boundary
- Ranges Included in the MMRP Range Inventory**
-  INPR Site No. 1 (Range Complex No. 1)
-  Demolition Area (Range Complex No. 1)
-  Reported MEC Find
-  Munitions Debris
-  Soil Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

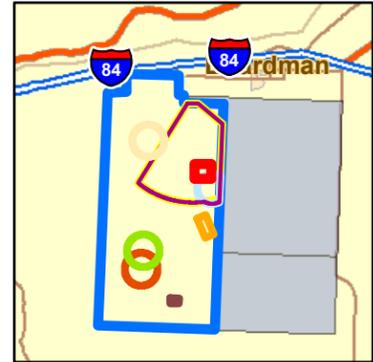
NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo was obtained from the U.S.G.S. and is dated September 20, 1965.

N

0 100 200 400
Feet



REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

BoardmanAFR_076_Fig7_4_--
 Demolition_METALS_SI
DRAWING NUMBER
 DRAWN BY
 K.Masterson 05/14/07
 OFFICE
 MINRVL

5070000
 5069800
 5069600

 U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 7-4
DEMOLITION AREA
RANGE COMPLEX NO. 1
SAMPLE LOCATIONS AND
METALS RESULTS
 BOARDMAN AIR FORCE RANGE

 Shaw Environmental, Inc.

284000 284200 284400 284600 284800 285000 285200

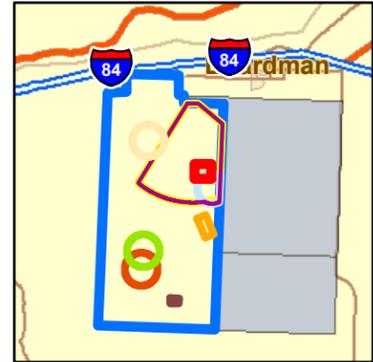
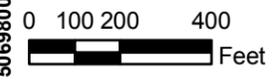
284000 284200 284400 284600 284800 285000 285200



Legend

-  Boardman Air Force Range FUDS Boundary
- Ranges Included in the MMRP Range Inventory**
-  INPR Site No. 1 (Range Complex No. 1)
-  Demolition Area (Range Complex No. 1)
-  Reported MEC Find
-  Munitions Debris
-  Soil Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

NOTES:
 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
 2) Aerial photo was obtained from the U.S.G.S. and is dated September 20, 1965.



REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

BoardmanAFR_077_Fig7_5_
 Demolition_EXPL_SI
DRAWING NUMBER
 DRAWN BY
 K.Masterson 05/14/07
 OFFICE
 MINRVL

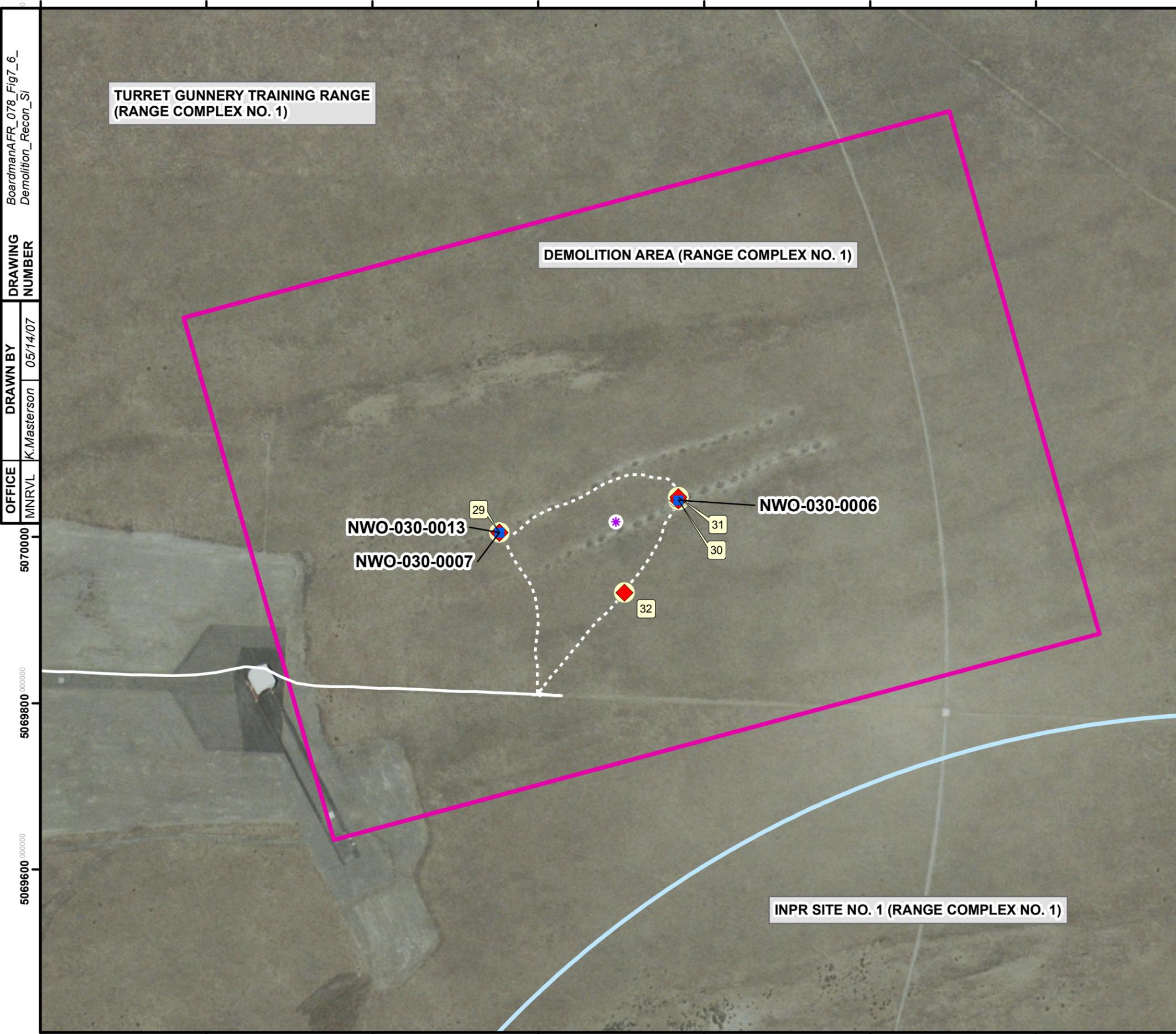
5070000
 5069800
 5069600

 U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 7-5
DEMOLITION AREA
RANGE COMPLEX NO. 1
SAMPLE LOCATIONS AND
EXPLOSIVES RESULTS
 BOARDMAN AIR FORCE RANGE

284000 284200 284400 284600 284800 285000 285200

284000 000000 284200 000000 284400 000000 284600 000000 284800 000000 285000 000000 285200 000000



BoardmanAFR_078_Fig7_6_
Demolition_Recon_Si

DRAWING NUMBER
DRAWN BY
K.Masterson 05/14/07

OFFICE
MINRVL

5070000

5069800

5069600

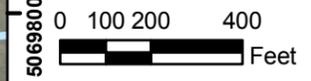
284000 000000 284200 000000 284400 000000 284600 000000 284800 000000 285000 000000 285200 000000

Legend

-  Boardman Air Force Range FUDS Boundary
- Ranges Included in the MMRP Range Inventory
-  INPR Site No. 1 (Range Complex No. 1)
-  Demolition Area (Range Complex No. 1)
-  Reported MEC Find
-  Reconnaissance Path Walked
-  Reconnaissance Path Driven
-  Munitions Debris
-  Soil Sample
-  Photograph Location

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

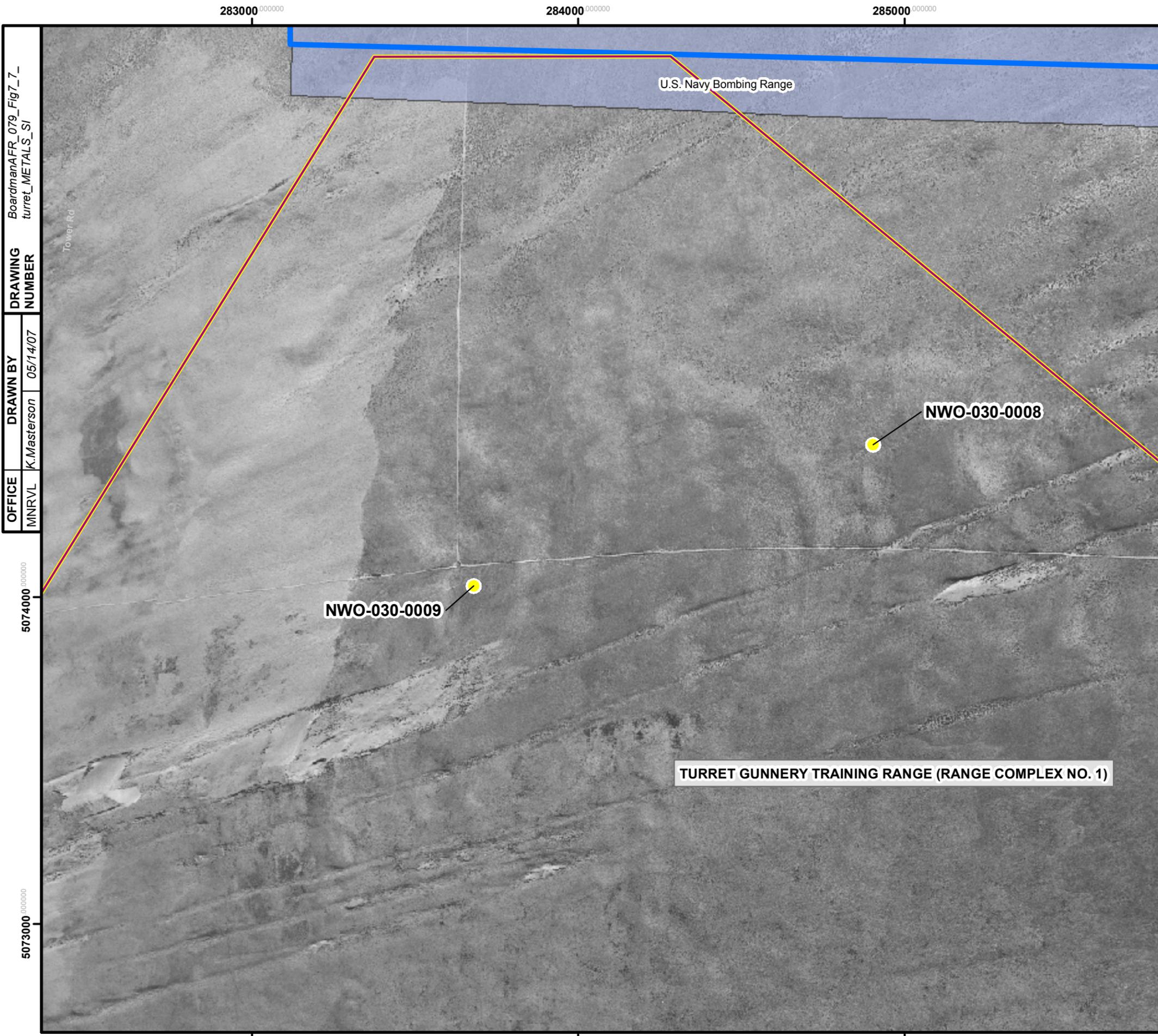


U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 7-6
DEMOLITION AREA
RANGE COMPLEX NO. 1
RECONNAISSANCE

BOARDMAN AIR FORCE RANGE





BoardmanAFR_079_Fig7_7_
 turret_METALS_SI

DRAWING NUMBER

DRAWN BY
 K. Masterson 05/14/07

OFFICE
 MNRVL

Legend

- Boardman Air Force Range FUDS Boundary
- Active U.S. Navy Bombing Range
- Ranges Included in the MMRP Range Inventory**
- Range Complex No. 1
- Turret Gunnery Training Range (Range Complex No. 1)
- Soil Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo was obtained from the U.S.G.S. and is dated October 21, 1958.

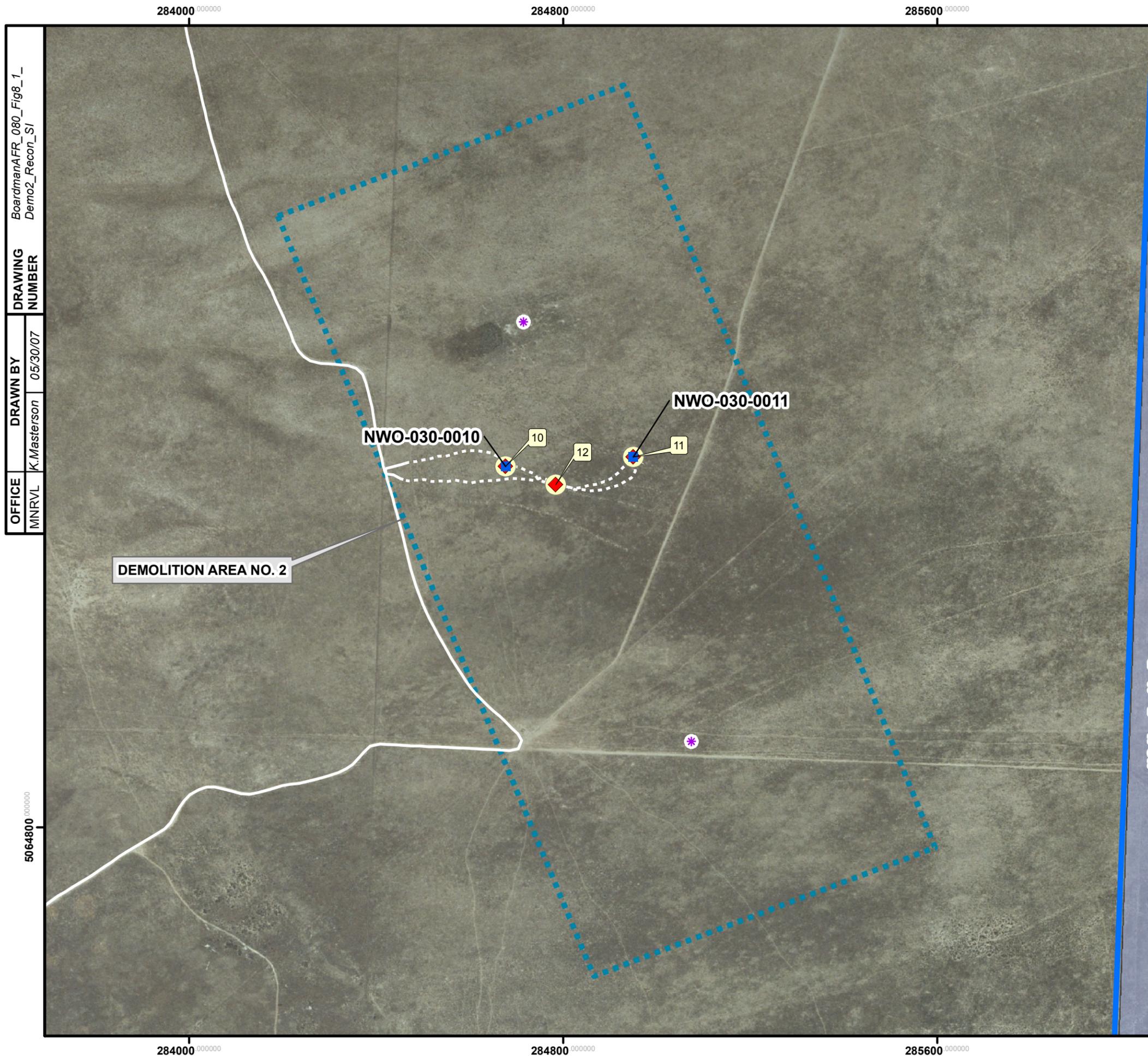
0 250 500 1,000
 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

TURRET GUNNERY TRAINING RANGE (RANGE COMPLEX NO. 1)

U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 7-7
TURRET GUNNERY RANGE
RANGE COMPLEX NO. 1
SAMPLE LOCATIONS AND METALS RESULTS
 BOARDMAN AIR FORCE RANGE



BOARDMAN AFR_080_Fig8_1_
 Demo2_Recon_SI
DRAWING NUMBER
 DRAWN BY
 K.Masterson 05/30/07
OFFICE
 MNRVL

Legend

- Boardman Air Force Range FUDS Boundary
- Demolition Area No. 2 (boundary not verified)
- Active U.S. Navy Bombing Range
- Reconnaissance Path Walked
- Reconnaissance Path Driven
- Munitions Debris
- Soil Sample
- Photograph Location
- Reported MEC Find

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.

5066400 000000

5065600 000000

U.S. Navy Bombing Range

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 8-1
DEMOLITION AREA NO. 2
RECONNAISSANCE
 BOARDMAN AIR FORCE RANGE

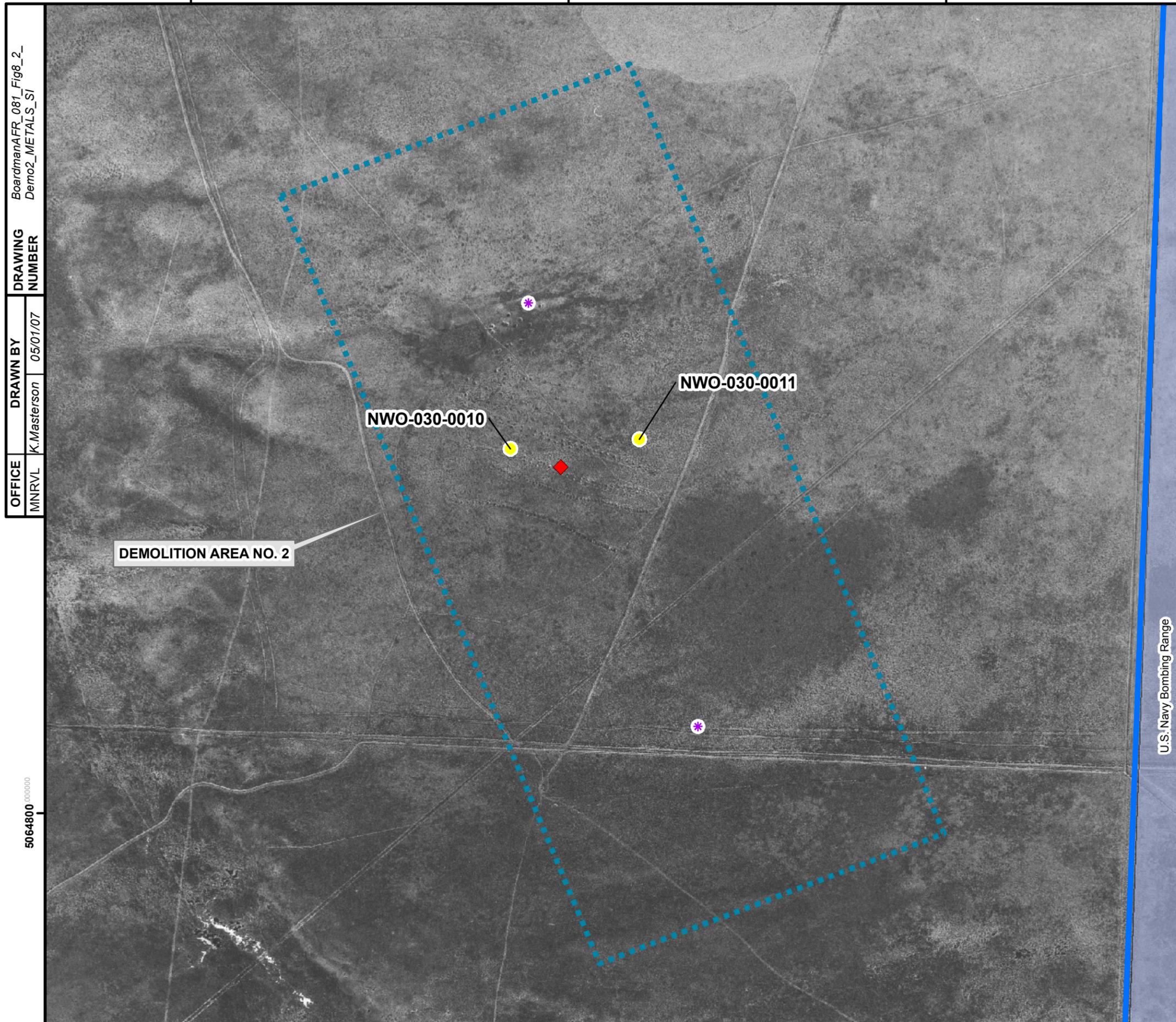
Shaw Environmental, Inc.

284000 000000 284800 000000 285600 000000

284000 000000 284800 000000 285600 000000

5064800 000000

284000 000000 284800 000000 285600 000000



BoardmanAFR_081_Fig8_2_
 Demo2_METALS_SI

DRAWING NUMBER

DRAWN BY
 K.Masterson 05/01/07

OFFICE
 MNRVL

Legend

- Boardman Air Force Range FUDS Boundary
- Demolition Area No. 2 (boundary not verified)
- Active U.S. Navy Bombing Range
- Reported MEC Find
- Munitions Debris
- Soil Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo was obtained from the U.S.G.S. and is dated September 20, 1965.

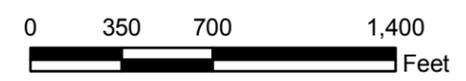
DEMOLITION AREA NO. 2

NWO-030-0010

NWO-030-0011

U.S. Navy Bombing Range

5066400 000000
 5065600 000000



REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

U.S. ARMY CORPS OF ENGINEERS
 OMAHA DESIGN CENTER

FIGURE 8-2
DEMOLITION AREA NO. 2
SAMPLE LOCATIONS AND METALS RESULTS
 BOARDMAN AIR FORCE RANGE



284000 000000 284800 000000 285600 000000

5064800 000000

284000 000000 284800 000000 285600 000000



BoardmanAFR_082_Fig8_3_
 Demo2_EXPL_SI

DRAWING NUMBER

DRAWN BY
 K.Masterson 05/30/07

OFFICE
 MNRVL

Legend

- Boardman Air Force Range FUDS Boundary
- Demolition Area No. 2 (boundary not verified)
- Active U.S. Navy Bombing Range
- Reported MEC Find
- Soil Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo was obtained from the U.S.G.S. and is dated September 20, 1965.

5066400 000000

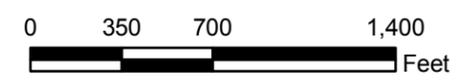
5065600 000000

U.S. Navy Bombing Range

DEMOLITION AREA NO. 2

NWO-030-0010

NWO-030-0011



REFERENCE/PROJECTION: NAD 83 UTM Zone 11N



U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

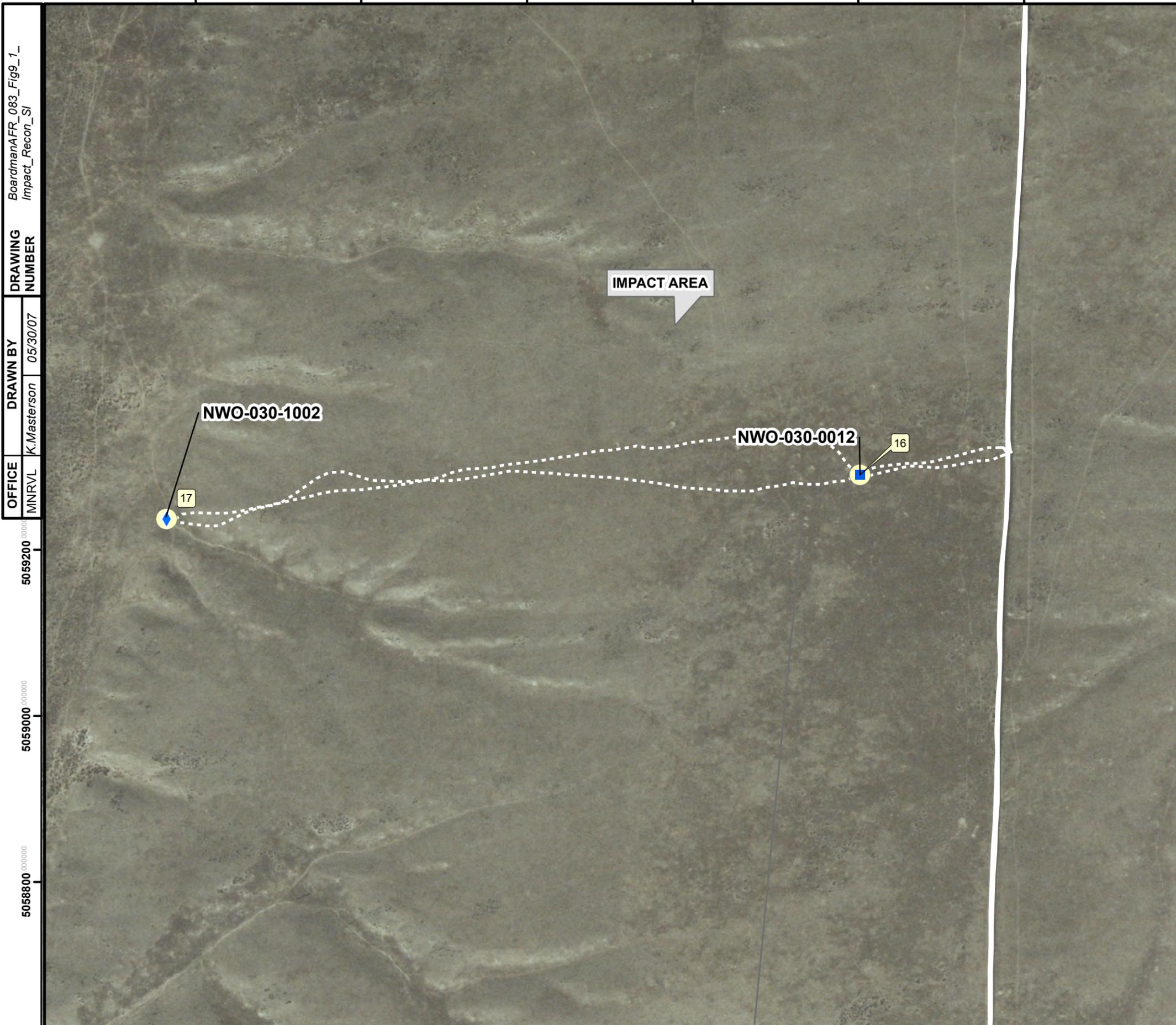
FIGURE 8-3
DEMOLITION AREA NO. 2
SAMPLE LOCATIONS AND
EXPLOSIVES RESULTS
 BOARDMAN AIR FORCE RANGE



5064800 000000

284000 000000 284800 000000 285600 000000

281600 000000 281800 000000 282000 000000 282200 000000 282400 000000 282600 000000



BoardmanAFR_083_Fig9_1_
Impact_Recon_Sl

DRAWING NUMBER

DRAWN BY
K.Masterson 05/30/07

OFFICE
MNRVL

5059200 000000

5059000 000000

5058800 000000

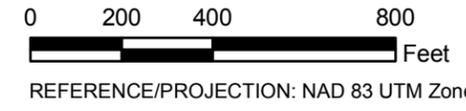
281600 000000 281800 000000 282000 000000 282200 000000 282400 000000 282600 000000

Legend

- Boardman Air Force Range FUDS Boundary
- Impact Area (boundary not defined)
- Reconnaissance Path Walked
- Reconnaissance Path Driven
- Soil Sample
- Sediment Sample
- Photograph Location

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



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FIGURE 9-1
IMPACT AREA
RECONNAISSANCE
BOARDMAN AIR FORCE RANGE



281600 000000 281800 000000 282000 000000 282200 000000 282400 000000 282600 000000

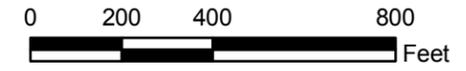


BoardmanAFR_084_Fig9_2_
Impact_METALS_SI
DRAWING NUMBER
DRAWN BY
K.Masterson 05/30/07
OFFICE
MNRVL

Legend

-  Boardman Air Force Range FUDS Boundary
-  Additional Areas Identified During Technical Planning
-  Impact Area (boundary not defined)
-  Sediment Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels
-  Soil Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

NOTES:
 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 1965.



REFERENCE/PROJECTION: NAD 83 UTM Zone 11N



U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

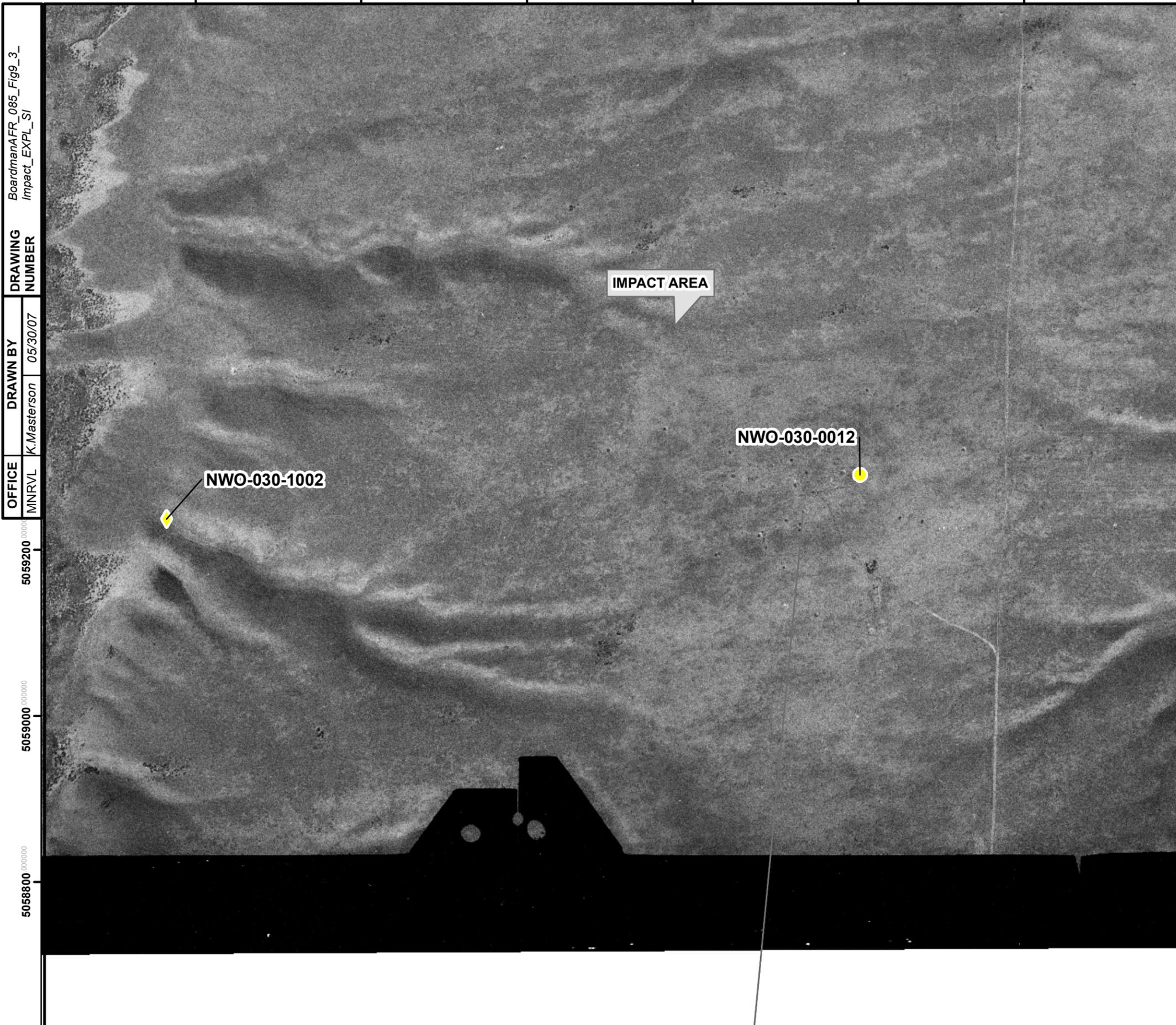
FIGURE 9-2
IMPACT AREA
SAMPLE LOCATIONS
AND METALS RESULTS

BOARDMAN AIR FORCE RANGE



281600 000000 281800 000000 282000 000000 282200 000000 282400 000000 282600 000000

281600 000000 281800 000000 282000 000000 282200 000000 282400 000000 282600 000000



BoardmanAFR_085_Fig9_3_
Impact_EXPL_SI
DRAWING NUMBER
DRAWN BY
K.Masterson 05/30/07
OFFICE
MNRVL

Legend

-  Boardman Air Force Range FUDS Boundary
-  Impact Area (boundary not defined)
-  Sediment Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels
-  Soil Sample Results were Less Than Background or Ecological and/or Human Health Screening Levels

NOTES:
 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 1965.



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FIGURE 9-3
IMPACT AREA
SAMPLE LOCATIONS AND
EXPLOSIVES RESULTS
BOARDMAN AIR FORCE RANGE



281600 000000 281800 000000 282000 000000 282200 000000 282400 000000 282600 000000

273600 278400 283200 288000 292800



Legend

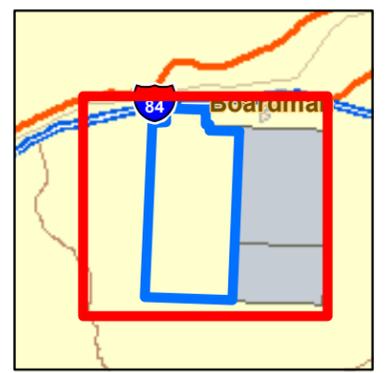
- Boardman Air Force Range FUDS Boundary
- Active U.S. Navy Bombing Range

Munition Response Site

- CARTY RESERVOIR BOMB TARGET
- RANGE COMPLEX NO. 1
- TARGET NO. 1
- TARGET NO. 2

NOTES:

- 1) FUDS boundary and range boundaries were derived from the Boardman AFR ASR Supplement.
- 2) Aerial photo (Morrow County) obtained from the U.S. Department of Agriculture, Service Center Agencies; photo is from the USDA-APFO National Agricultural Inventory Project (NAIP), 2006.



0 0.75 1.5 3 Miles

REFERENCE/PROJECTION: NAD 83 UTM Zone 11N

BoardmanAFR_086
 Fig11_1_MRS_Sl_
DRAWING NUMBER
 DRAWN BY
 K.Masterson
 05/13/07
OFFICE
 mnrvl

U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 11-1

MUNITIONS RESPONSE SITES

BOARDMAN AIR FORCE RANGE

Shaw Environmental, Inc.

273600 278400 283200 288000 292800

Tables

**Table 2-1
Munitions Information
Boardman Air Force Range**

AOC	Range Munitions	Munitions Constituents
Target No. 1	Practice Bombs: AN-Mk 5, AN-Mk 23, AN-Mk 43, Mk 4 (signal charge)	Steel (chromium, copper, iron, molybdenum, nickel), cast iron (iron), or lead, lead-based paints, black powder (potassium nitrate, sulfur, charcoal), red phosphorus
	M38A2 Practice Bomb, 100-lb	Sheet metal (iron), lead-based paints, inert sand filled, 3 lb black powder (potassium nitrate, sulfur, charcoal)
Target No. 2	AN-M50A2 Incendiary Bomb, 4-lb	Magnesium alloy casing, 0.63 lb thermite (powdered aluminum metal and ferric oxide), lead-based paints
	AN-M52 Incendiary Bomb, 2-lb	Magnesium alloy, 0.4 lb thermite (powdered aluminum metal and ferric oxide), lead-based paints
	M38A2 Practice Bomb, 100-lb	Sheet metal (iron), lead-based paints, inert sand filled, 3 lb black powder (potassium nitrate, sulfur, charcoal)
	AN M-47	Sheet metal (iron), inert
	MK-15, Mod 3	Sheet metal(iron) , spotting charge consisting of 1 lb. black powder (potassium nitrate, sulfur, charcoal)
	2.25-inch Practice Rocket MK6	Sheet metal (iron), ballistite (nitrocellulose and nitroglycerin)
	AN-M57 GP Practice Bomb	Sheet metal (iron), lead-based paints, spotting charge
	75-mm HEAT M66 projectiles (disposed in area)	Steel (chromium, copper, iron, molybdenum, nickel), lead azide, potassium chlorate, antimony sulfide, carborundum 150, tetryl, lead styphnate, tetracene, barium nitrate, lead sulfphocyanate, TNT
Carty Reservoir	AN-Mk 23	Cast iron (iron), black powder (potassium nitrate, sulfur, charcoal), red phosphorus
	M38A2	Sheet metal (iron), inert sand filled, 3 lb black powder (potassium nitrate, sulfur, charcoal)
	M75/M84 Target ID Bomb	Sheet metal (iron), lead-based paints, red iron oxide, tetryl
Range Complex No. 1	Small Arms – 50 caliber, M2 Ball, M1 Tracer, M10 Tracer	Soft steel (chromium, copper, iron, lead, molybdenum, nickel), lead, single (nitrocellulose) or double base powder (nitrocellulose and nitroglycerin), tracer (calcium resinate, strontium peroxide, magnesium powder, strontium nitrate), perchlorate
	BDU-33, MK 76	Cast iron (iron), steel (chromium, copper, iron, molybdenum, nickel), sheet metal (iron), lead-based paints, 10 gauge shotgun shell
	Mk-84	Inert, steel (chromium, copper, iron, molybdenum, nickel), sheet metal (iron)

**Table 2-1 (Cont.)
Munitions Information
Boardman Air Force Range**

AOC	Range Munitions	Munitions Constituents
Range Complex No. 1	Small Arms – 50 caliber, M2 Ball, M1 Tracer, M10 Tracer	Soft steel (chromium, copper, iron, lead, molybdenum, nickel), lead, single (nitrocellulose) or double base powder (nitrocellulose and nitroglycerin), tracer (calcium resinate, strontium peroxide, magnesium powder, strontium nitrate), perchlorate
	BDU-33, MK 76	Cast iron (iron), steel (chromium, copper, iron, molybdenum, nickel), sheet metal (iron), lead-based paints, 10 gauge shotgun shell
	Mk-84	Inert, steel (chromium, copper, iron, molybdenum, nickel), sheet metal (iron)
	BLU-95 (likely drift over from adjacent Navy range)	Ethylene oxide
	Mark-12 Practice Nuclear Bomb	Sheet metal (iron), lead-based paints, Inert, concrete filled, steel sheet metal
	Mk 106 5-lb	Sheet metal (iron), lead-based paints, single- (nitrocellulose) or double-base (nitrocellulose and nitroglycerin) powder
	Mk 89, 56-lb	Soft steel (chromium, copper, iron, lead, molybdenum, nickel), lead-based paints, 10 gauge shotgun shell, red phosphorus
	Medium caliber practice – 20-mm Ball Mk 1	Soft steel (chromium, copper, iron, lead, molybdenum, nickel), single (nitrocellulose) or double base (nitrocellulose and nitroglycerin) powder
	Explosives C-4 blocks	RDX
	Explosives Detonating Cord, M60 Igniter	PETN
Demolition Area No. 2	M83 Fragmentation Bombs (Butterfly Bomblets)	Steel, (chromium copper, iron, molybdenum, nickel), sheet metal (iron), TNT
	M66, M68 Detonating Fuzes	Mercury fulminate, lead azide, tetryl,
	100-lb GP Bomb	Cast iron (iron), lead-based paints, TNT, Amatol (ammonium nitrate, TNT), Tritonal (TNT aluminum powder), lead styphnate, lead azide, tetryl, mercury fulminate
	Explosives C-4 Blocks	RDX
	Explosives Detonating Cord	PETN
	M60 Igniter	Lead azide
Impact Area (note munitions listed are only suspected)	Practice Bombs: AN-Mk 5, AN-Mk 23, AN-Mk 43, Mk 4 (signal charge)	Steel (chromium, copper, iron, molybdenum, nickel), cast iron (iron), or lead, lead-based paints, black powder (potassium nitrate, sulfur, charcoal), red phosphorus
Suspected Use - No AOC Specified	Practice Bomb BDU-10 series, 2,025-lb	Steel (chromium, copper, iron, molybdenum, nickel), lead-based paints, Inert (hot gas generator in folding fins configuration)
	M66 and M68 Base Detonating Fuze for 75-mm and 90-mm projectiles	TNT or 50/50 pentolite (TNT and PETN), mercury fulminate, tetryl

AOC = area of concern;

lb = pound

PETN = pentaerythritol tetranitrate

RDX= Hexahydro-1,3,5-trinitro-1,3,5-triazine

TNT = 2,4,6-Trinitrotoluene

**Table 2-2
Army Checklist for Important Ecological Places ^a
Boardman Air Force Range**

No.	Criteria	Yes / No	Comments
1	Locally important ecological place identified by the Integrated Natural Resource Management Plan, BRAC Cleanup Plan or Redevelopment Plan, or other official land management plans	<input checked="" type="checkbox"/> / <input type="checkbox"/>	Portions of the Site are within the Three-mile Canyon Farms Multi-Species Candidate Conservation Agreement with Assurances (MSCCAA) area created by the U.S. Fish and Wildlife Service (USFWS), in cooperation with the Oregon Department of Fish and Wildlife (ODFW), The Nature Conservancy, and Portland General Electric. MSCCAAs contain a strategy for covered lands and activities that demonstrate an applicant's contribution to preclude or remove the need to list a covered species as threatened or endangered under the Act.
2	Critical habitat for Federal designated endangered or threatened species	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
3	Marine Sanctuary	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
4	National Park	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
5	Designated Federal Wilderness Area	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
6	Areas identified under the Coastal Zone Management Act	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
7	Sensitive Areas identified under the National Estuary Program or Near Coastal Waters Program	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
8	Critical areas identified under the Clean Lakes Program	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
9	National Monument	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
10	National Seashore Recreational Area	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
11	National Lakeshore Recreational Area	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
12	Habitat known to be used by Federal designated or proposed endangered or threatened species	<input checked="" type="checkbox"/> / <input type="checkbox"/>	ODFW and USFWS state that 2 bird, 2 mammal, 3 fish, 2 butterfly, and 8 plant threatened or endangered species may be present in the site area.
13	National preserve	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
14	National or State Wildlife Refuge	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
15	Unit of Coastal Barrier Resources System	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
16	Coastal Barrier (undeveloped)	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
17	Federal land designated for protection of natural ecosystems	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
18	Administratively Proposed Federal Wilderness Area	<input type="checkbox"/> / <input checked="" type="checkbox"/>	

**Table 2-2 (Cont.)
Army Checklist for Important Ecological Places ^a
Boardman Air Force Range**

No.	Criteria	Yes / No	Comments
19	Spawning areas critical for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
20	Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which fish spend extended periods of time	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
21	Terrestrial areas utilized for breeding by large or dense aggregations of animals	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
22	National river reach designated as Recreational	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
23	Habitat known to be used by state designated endangered or threatened species	<input checked="" type="checkbox"/> / <input type="checkbox"/>	ODFW and USFWS state that 2 bird, 2 mammal, 3 fish, 2 butterfly, and 8 plant threatened or endangered species may be present in the site area.
24	Habitat known to be used by species under review as to its Federal endangered or threatened status	<input checked="" type="checkbox"/> / <input type="checkbox"/>	Washington Ground Squirrel is a candidate species
25	Coastal Barrier (partially developed)	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
26	Federally designated Scenic or Wild River	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
27	State land designated for wildlife or game management	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
28	State-designated Scenic or Wild River	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
29	State-designated Natural Areas	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
30	Particular areas, relatively small in size, important to maintenance of unique biotic communities	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
31	State-designated areas for protection or maintenance of aquatic life	<input type="checkbox"/> / <input checked="" type="checkbox"/>	
32	Wetlands	<input checked="" type="checkbox"/> / <input type="checkbox"/>	Wetlands likely around Carty Reservoir and/or along Six-Mile Canyon Creek.
33	Fragile landscapes, land sensitive to degradation if vegetative habitat or cover diminishes	<input type="checkbox"/> / <input checked="" type="checkbox"/>	

a – Based on EPA, 1990, 55 FR 51624, Table 4-23 – Sensitive Environments Rating Values, Dec. 14, 1990; EPA, 1997, E RAGS, Exhibit 1-1 List of Sensitive Environments.

**Table 2-3
Summary of Weston 2004 PA/SI Sampling^a
Boardman Air Force Range**

PA/SI Sample ID	UTM Northing	UTM Easting	Matrix	Sample Date	Sample Interval (ft)	TAL Metals (ILM05.3)	Explosives by SW-846-8330	Perchlorate by 314.0	Perchlorate by SW-846-8321-A Modified
Domestic Well Groundwater									
BAFR-GW-DW001-0000	5077207.937	283861.5424	GW	6/21/04	UNK		X	X	
BAFR-GW-DW002-0000	5077549.415	288459.2144	GW	6/22/2004	UNK		X	X	X
BAFR-GW-DW003-0000	5076690.238	284808.6526	GW	6/21/2004	UNK		X	X	
Drinking water Supply Well Groundwater									
BAFR-GW-DS001-0000	5077331.803	282422.9545	GW	6/22/2004	UNK		X	X	
BAFR-GW-DS002-0000	5077245.199	281591.3009	GW	6/22/2004	UNK		X	X	
BAFR-GW-DS003-0000	5064320.848	280974.6486	GW	6/23/2004				X	
Monitoring Well Groundwater									
BAFR-GW-MW001-0000	5077529.962	293028.744	GW	6/22/2004	UNK		X	X	
BAFR-GW-MW002-0000	5077518.146	294535.1342	GW	6/22/2004	UNK		X	X	
BAFR-GW-MW003-0000	5077214.44	291647.1872	GW	6/22/2004	UNK		X	X	
BAFR-GW-MW005-0000	1749288.801	218899.8815	GW	6/22/2004	UNK		X	X	
BAFR-GW-MW006-0000	5075900.245	296111.4942	GW	6/22/2004	UNK		X	X	
BAFR-GW-MW007-0000	5075962.364	293998.9057	GW	6/22/2004	UNK		X	X	X
BAFR-GW-MW009-0000	5076015.673	292219.8429	GW	6/22/2004	UNK		X	X	
BAFR-GW-MW011-0000	5080552.875	292498.0653	GW	6/21/2004	UNK		X	X	
BAFR-GW-MW012-0000	5080588.542	292430.3931	GW	6/21/2004	UNK		X	X	X
BAFR-GW-MW013-0000	5080595.711	292391.3932	GW	6/21/2004	UNK		X	X	
BAFR-GW-MW014-0000	5080599.793	292485.6687	GW	6/21/2004	UNK		X	X	
BAFR-GW-MW015-0000	5080705.283	292290.2968	GW	6/21/2004	UNK		X	X	
BAFR-GW-MW016-0000	5074075.184	276359.5285	GW	6/23/2004	UNK		X	X	
BAFR-GW-MW017-0000	5069561.232	275938.3925	GW	6/23/2004	UNK		X	X	X
BAFR-GW-MW020-0000	5068061.885	275382.3642	GW	6/23/2004	UNK		X	X	X
BAFR-GW-MW022-0000	5065211.717	276483.3325	GW	6/24/2004	UNK		X	X	X
BAFR-GW-MW023-0000	5066786.328	279481.7059	GW	6/24/2004	UNK		X	X	X
BAFR-GW-MW024-0000	5063978.762	280063.3955	GW	6/24/2004	93 - 103		X	X	
BAFR-GW-MW025-0000	5061794.241	283074.9631	GW	6/24/2004	58 - 68		X	X	
Carty Reservoir Surface Water									
BAFR-SW-CR001-0000	5063641.789	281293.0393	SW	6/24/2004	NA			X	
Sixmile Canyon Creek Surface Water									
BAFR-SW-SC001-0000	5075362.798	277170.4606	SW	6/24/2004	NA			X	X
BAFR-SW-SC002-0000	5072281.374	278226.7296	SW	6/24/2004	NA			X	
BAFR-SW-SC004-0000	5067498.182	277544.9651	SW	6/24/2004	NA			X	
BAFR-SW-SC005-0000	5065682.547	276753.6786	SW	6/24/2004	NA			X	
BAFR-SW-SC006-0000	5064320.848	280974.6486	SW	6/24/2004	NA			X	

**Table 2-3 (Cont.)
Summary of Weston 2004 PA/SI Sampling^a
Boardman Air Force Range**

PA/SI Sample ID	UTM Northing	UTM Easting	Matrix	Sample Date	Sample Interval (ft)	TAL Metals (ILM05.3)	Explosives by SW-846-8330	Perchlorate by 314.0	Perchlorate by SW-846-8321-A Modified
Target No. 2 (Area C) Surface Soil									
BAFR-SS-PS003-0000	5074081.967	280669.1067	SS	6/23/2004	0 - 0.5	X		X	
BAFR-SS-PS005-0000	5074057.031	280645.0757	SS	6/23/2004	0 - 0.5	X		X	
Target No. 2 (Area C) Subsurface Soil									
BAFR-SB-PS003-0015	5074081.967	280669.1067	SB	6/23/2004	0.5 - 2.0	X		X	
BAFR-SB-PS005-0015	5074057.031	280645.0757	SB	6/23/2004	0.5 - 2.0	X		X	
INPR Target No. 1 (Area E) Surface Soil									
BAFR-SS-PS001-0000	5068952.218	285664.2264	SS	6/23/2004	0 - 0.5	X		X	
BAFR-SS-PS002-0000	5068881.604	285474.6113	SS	6/23/2004	0 - 0.5	X	X	X	
INPR Target No. 1 (Area E) Subsurface Soil									
BAFR-SB-PS001-0015	5068952.218	285664.2264	SB	6/23/2004	0.5 - 2.0	X		X	
BAFR-SB-PS002-0015	5068881.604	285474.6113	SB	6/23/2004	0.5 - 2.0	X	X	X	
Sixmile Canyon Creek Sediment									
BAFR-SD-SC002-0000	5072044.851	278490.0705	SD	6/24/2004	0 - 0.5	X			

Notes

^a Boardman Air Force Range FUDS Preliminary Assessment/Site Inspection Report, TDD: 01-08-0006, Weston Solutions for U.S. EPA Region X, September, 2004.

X = indicates sample analyzed for parameter

Shaded areas indicate samples from locations off-site of Boardman Air Force Range FUDS

Abbreviations and Acronyms

ft = feet

GW = groundwater

PA/SI = Preliminary Assessment/Site Inspection

SB = subsurface soil

SD = sediment

SS = surface soil

SW = surface water

TAL = target analyte list metals

UNK = screen interval is unknown, information not provided in PA/SI report.

UTM = Universal Transverse Mercator, Zone 11

Analytical Methods

314.0 = EPA Method 314.0 determination of Perchlorate in Drinking Water by Ion Chromatography (EPA, 2000a).

8321-A = EPA SW-846 Method 8321-modified Determination of Perchlorate by Liquid Chromatography/Mass Spectrometry (STL, 2003).

8330 = EPA SW-836 Method 8330 Determination of Nitroaromatics and Nitramines by High Performance Liquid Chromatography.

ILM05.3 = EPA Contract Laboratory Program Statement of Work for Inorganics Analysis (CLP-SOW)

**Table 2-4
Locations of Confirmed MEC Finds^a
Boardman Air Force Range**

AOC	Ordnance Found ^b
Target No. 1	Mk-76 practice bomb M38A2 100-lb practice bomb
Target No. 2	56-lb practice bombs 75-mm projectiles 100-lb practice bombs 2.25-inch rockets 2-lb to 4-lb incendiary bomblets AN-M57 GP practice bombs AN-47 AN-M50 incendiary bomb M38A2 practice bombs Mk 6 2.25-inch practice rocket
Carty Reservoir Bomb Target	100-lb practice bombs
Range Complex No. 1	
INPR Site No. 1	56-lb practice bombs BDU-10 practice bombs
Demolition Range	Fragments
Demolition Range No. 2	M-83 butterfly bomb

^a Locations are shown on Figure 2-10 of this SI Report.

^b Sources: ASR, 1997; L. Nelson, The Nature Conservancy 2006; PA/SI (Weston, 2004); S. Anderson, PGE 2006.

**Table 3-1
Summary of Samples Collected for Site Inspection
Boardman Air Force Range**

Location ID	Sample Number	UTM Northing	UTM Easting	Sample Purpose	Sample Type	Date Collected	Sample Depth (ft)	Laboratory SDG Number	Select Metals* by EPA SW-846 6020A	Mercury by EPA SW-846 7471A	Explosives by EPA SW-846 8330A	Nitroglycerine by EPA SW-846 8330A (Modified)	PETN by EPA SW-846 8330A (Modified)
Target No. 1													
030A001	NWO-030-0001	5063362	279813	REG	SS	27-Feb-07	0 - 0.5	703016-001	X	X	X	X	
Target No. 2													
030A002	NWO-030-0002	5072790	279899	REG	SS	27-Feb-07	0 - 0.5	703016-002	X	X	X	X	
030A003	NWO-030-0003	5072287	280581	REG	SS	28-Feb-07	0 - 0.5	703016-003	X	X	X	X	
Carty Reservoir Bomb Target													
030A004	NWO-030-0004	5062058	279533	REG	SS	27-Feb-07	0 - 0.5	703016-004	X	X			
030A005	NWO-030-0005	5061497	280459	REG	SS	26-Feb-07	0 - 0.5	703016-005	X	X	X	X	
030A006	NWO-030-1001	5062016	279650	REG	SD	27-Feb-07	0 - 0.5	703016-006	X	X	X	X	
	NWO-030-1003	5062016	279650	FD	SD	27-Feb-07	0 - 0.5	703016-007	X	X	X	X	
Range Complex No. 1, Demolition Area													
030A007	NWO-030-0006	5070044	284769	REG	SS	28-Feb-07	0 - 0.5	703016-008	X	X	X	X	X
030A008	NWO-030-0007	5070005	284553	REG	SS	28-Feb-07	0 - 0.5	703016-009	X	X	X	X	X
	NWO-030-0013	5070005	284553	FD	SS	28-Feb-07	0 - 0.5	703016-010	X	X	X	X	X
Range Complex No. 1, Turret Gunnery Range													
030A009	NWO-030-0008	5074466	284904	REG	SS	26-Feb-07	0 - 0.5	703016-011	X	X			
030A010	NWO-030-0009	5074034	283679	REG	SS	27-Feb-07	0 - 0.5	703016-012	X	X			
Demolition Area No. 2													
030A011	NWO-030-0010	5065570	284677	REG	SS	27-Feb-07	0 - 0.5	703016-013	X	X	X	X	X
	NWO-030-0010-MS	5065570	284677	MS	SS	27-Feb-07	0 - 0.5	703016-013-MS	X	X	X	X	X
	NWO-030-0010-MSD	5065570	284677	MSD	SS	27-Feb-07	0 - 0.5	703016-013-MSD	X	X	X	X	X
030A012	NWO-030-0011	5065590	284950	REG	SS	27-Feb-07	0 - 0.5	703016-014	X	X	X	X	X
Impact Area													
030A013	NWO-030-0012	5059290	282402	REG	SS	27-Feb-07	0 - 0.5	703016-015	X	X	X	X	
030A014	NWO-030-1002	5059237	281565	REG	SD	27-Feb-07	0 - 0.5	703016-016	X	X	X	X	
Background													
030A015	NWO-030-5001	5059936	282313	REG	SS	27-Feb-07	0 - 0.5	703017-001	X	X			
	NWO-030-5012	5059936	282313	FD	SS	27-Feb-07	0 - 0.5	703017-012	X	X			
030A016	NWO-030-5002	5059677	279861	REG	SS	26-Feb-07	0 - 0.5	703017-002	X	X			
030A017	NWO-030-5003	5059531	278687	REG	SS	26-Feb-07	0 - 0.5	703017-003	X	X			
030A018	NWO-030-5004	5059404	277541	REG	SS	26-Feb-07	0 - 0.5	703017-004	X	X			
030A019	NWO-030-5005	5058129	276422	REG	SS	26-Feb-07	0 - 0.5	703017-005	X	X			
	NWO-030-5005-MS	5058129	276422	MS	SS	26-Feb-07	0 - 0.5	703017-005-MS	X	X			
	NWO-030-5005-MSD	5058129	276422	MSD	SS	26-Feb-07	0 - 0.5	703017-005-MSD	X	X			
030A020	NWO-030-5006	5063545	284883	REG	SS	27-Feb-07	0 - 0.5	703017-006	X	X			
030A021	NWO-030-5007	5067017	280686	REG	SS	26-Feb-07	0 - 0.5	703017-007	X	X			
030A022	NWO-030-5008	5061321	284035	REG	SS	27-Feb-07	0 - 0.5	703017-008	X	X			
030A023	NWO-030-5009	5057948	284517	REG	SS	27-Feb-07	0 - 0.5	703017-009	X	X			
030A024	NWO-030-5010	5065870	282431	REG	SS	26-Feb-07	0 - 0.5	703017-010	X	X			
030A025	NWO-030-5011	5057525	281183	REG	SD	26-Feb-07	0 - 0.5	703017-011	X	X			

Notes:

X - Indicates a sample was collected and analyzed for the given parameter

* Select metals are aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel.

FD - field duplicate

MS - matrix spike

MSD - matrix spike duplicate

REG - regular field sample

SD - sediment

SDG - sample delivery group

SS - surface soil (< 0.5ft bgs)

UTM - Universal Transverse Mercator, Zone 11

**Table 3-2
Background Screening Values for Soil, Sediment and Groundwater
Boardman Air Force Range**

Element	Soil Background Value 95th UTL/95th Percentile^a (based on 10 samples^b) (mg/kg)	Sediment Background Value (based on 1 sample^b) (mg/kg)	Groundwater Background Value (based on 1 sample^c) (µg/L)
Aluminum	21,900	10,500	<100
Chromium	26.1	13.2	<1
Copper	33.0	13.6	<1
Iron	36,900	22,400	<10
Lead	17.7	7.1	<1
Mercury	<0.036	<0.014	<0.2
Molybdenum	0.44	0.31	NVA
Nickel	20.3	10.9	NVA
Perchlorate	NVA	NVA	3.86 ^d

Notes

^aThe 95th UTLs are provided for analytes with normal or lognormal distributions. The 95th percentiles are provided for analytes with distributions that are neither normal nor lognormal, or that have greater than 15 percent nondetects (per EPA, 1989); supporting calculations for soil background values are provided in appendix L

^bAnalytical results provided in Appendix G

^cGroundwater background concentrations from PGE Boardman Plant 2005 Water Quality Monitoring Report provided in Appendix L.

^dGroundwater background concentration for perchlorate from Boardman Air Force Range FUDS Preliminary Assessment/Site Inspection Report, Weston, 2004.

Abbreviations and Acronyms

mg/kg = milligrams per kilogram.

UTL = upper tolerance limit.

NVA = No value available.

< = less than

µg/L = micrograms per liter

**Table 3-3
Human Health Screening Values for Soil/Sediment and Groundwater^a
Boardman Air Force Range**

Analyte	Abbreviation	Soil/Sediment Human Health Screening Values (mg/kg)	Groundwater Human Health Screening Values (µg/L)
Explosives			
1,3,5-Trinitrobenzene	1,3,5-TNB	1,800	1,100
1,3-Dinitrobenzene	1,3-DNB	6.1	3.6
2,4,6-Trinitrotoluene	2,4,6-TNT	16	2.2
2,4-Dinitrotoluene	2,4-DNT	0.72	0.099
2,6-Dinitrotoluene	2,6-DNT	0.72	0.099
2-Amino-4,6-dinitrotoluene	2-Am-DNT	12	7.3
2-Nitrotoluene	2-NT	0.88	0.049
3-Nitrotoluene	3-NT	730	120
4-Amino-2,6-dinitrotoluene	4-Am-DNT	12	7.3
4-Nitrotoluene	4-NT	12	0.66
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	4.4	0.61
Methyl-2,4,6-trinitrophenylnitramine	tetryl	610	360
Nitrobenzene	NB	20	3.4
Nitroglycerin	NG	35	NVA
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	3,100	1,800
Metals/Inorganics			
Aluminum	Al	76,000	36,000
Chromium ^b	Cr	210	100
Copper	Cu	3,100	1,300
Iron	Fe	23,000	11,000
Lead	Pb	400	15
Mercury	Hg	23	NVA
Molybdenum	Mo	390	180
Nickel	Ni	1,600	730
Perchlorate		NVA	24

Notes

^a Selection of Human Health Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of this SI Report.

^b Total chromium values used.

Abbreviations and Acronyms

NVA = no value available

mg/kg = milligrams per kilogram

µg/L = micrograms per liter

**Table 3-4
Ecological Screening Values for Soil and Sediment^a
Boardman Air Force Range^a**

Analyte	Abbreviation	Soil Ecological Screening Value (mg/kg)	Sediment Ecological Screening Value (mg/kg)
Explosives			
1,3,5-Trinitrobenzene	1,3,5-TNB	0.376	0.024
1,3-Dinitrobenzene	1,3-DNB	0.655	0.067
2,4,6-Trinitrotoluene	2,4,6-TNT	6.4	0.92
2,4-Dinitrotoluene	2,4-DNT	1.28	0.29
2,6-Dinitrotoluene	2,6-DNT	0.0328	1.9
2-Amino-4,6-Dinitrotoluene	2-Am-4,6-DNT	2.1	7
2-Nitrotoluene	2-NT	2	5.6
3-Nitrotoluene	3-NT	2.4	4.9
4-Amino-2,6-Dinitrotoluene	4-Am-2,6-DNT	0.73	1.9
4-Nitrotoluene	4-NT	4.4	10
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	7.5	0.13
Methyl-2,4,6-trinitrophenylnitramine	tetryl	0.99	100
Nitrobenzene	NB	8	32
Nitroglycerin	NG	71	1,700
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	27	0.047
Pentaerythritol tetranitrate	PETN	8600	120,000
Metals			
Aluminum	Al	50	280
Chromium ^b	Cr	0.4	37
Copper	Cu	50	10
Iron	Fe	10	20
Lead	Pb	16	35
Mercury	Hg	0.1	0.2
Molybdenum	Mo	2	NVA
Nickel	Ni	30	18

Notes

^a Selection of Ecological Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of this SI Report.

^b Total chromium values used.

Abbreviations and Acronyms

NVA = no value available

mg/kg = milligrams per kilogram

µg/L = micrograms per liter

Table 4-1
Comparison of Target No. 1 Soil Analytical Detections to
Background, Human Health and Ecological Screening Values^a
Boardman Air Force Range

Location							030A001	
Sample Date							27-Feb-07	
Sample Number							NWO-030-0001	
Sample Depth (ft bgs)							0 to 0.5	
Sample Purpose							REG	
Fraction	Parameter	Units	Site Inspection Background 95th UTL / 95th Percentile	Site Inspection Ecological Screening Levels^a	Human Health Screening Levels EPA Region 9 PRGs - Residential Soil	Result	Validation Qualifier	
Metals	Chromium	mg/kg	26.1	0.4	210	<i>13.5</i>		
Metals	Copper	mg/kg	33	50	3100	14.1		
Metals	Iron	mg/kg	36900	10	23000	<i>20800</i>		
Metals	Lead	mg/kg	17.7	16	400	5.6		
Metals	Mercury	mg/kg	0.036	0.1	23	0.0048	J	
Metals	Nickel	mg/kg	20.3	30	1600	12.4		

Notes

^a Selection of Ecological Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of this SI Report.

[**Bold**] - Result exceeds Site Inspection Background 95th UTL / 95th Percentile

[*Italicized*] - Result exceeds Site Inspection Ecological Screening Level

[Underline] - Result exceeds EPA Region 9 PRG - Residential Soil

Abbreviations and Acronyms

ft bgs = feet below ground surface

mg/kg = milligram per kilogram

PRG = Preliminary Remediation Goal

REG = regular sample

UTL = upper tolerance limit

Validation Qualifier Definitions

J = The compound or analyte was positively identified but the reported value is estimated.

R = The reported sample results are rejected because of one of the following: severe deficiencies in the supporting quality control data; anomalies noted in the sampling and/or analysis process which could affect the validity of the reported data; the presence or absence of the constituent cannot be verified based on the data provided; to indicate not to use a particular result in the event of a reanalysis.

U = The compound or analyte was analyzed for but not detected above the associated reporting limit.

UJ = The compound or analyte was analyzed for but not detected above the established reporting limit. However, review and evaluation of supporting QC data and/or sampling and analysis process have indicated that the reporting limit may be inaccurate or imprecise. The nondetect result should be estimated.

**Table 4-2
Comparison of Target No. 1 Groundwater Analytical Detections to
Background and Human Health Screening Values
Boardman Air Force Range**

Location						PGE Well 008 ^a		PA/SI Sample ^b	
Sample Date						2005		24-Jun-04	
Sample Number						Unknown		GW-MW024-0000	
Sample Depth (ft bgs)						93 - 103		93 - 103	
Sample Purpose						REG		REG	
Fraction	Parameter	Units	Maximum Concentration from Media Background Sample ^c	"3x" Maximum Concentration from Media Background Sample	Human Health Screening Values ^d	Result	Validation Qualifier	Result	Validation Qualifier
Metals	Chromium	ug/L	<1	<1	100	<1		NA	
Metals	Copper	ug/L	<1	<1	1,300	<2		NA	
Metals	Iron	ug/L	<10	<10	11,000	50		NA	
Metals	Lead	ug/L	<1	<1	15	<1		NA	
Metals	Mercury	ug/L	<0.2	<0.2	NVA	<0.2		NA	
Perchlorate	Perchlorate	ug/L	3.56	10.68	24	NA		<1.0	

Notes

^a Sample results from *PGE Boardman Plant 2005 Water Quality Monitoring Report*

^b PA/SI - *Boardman AFR Preliminary Assessment/Site Inspection Report TDD:01-08-0006*, (Weston Solutions, 2004)

^c Groundwater background sample concentrations are from: metals - well 120, PGE Boardman Plant 2005 Water Quality Monitoring Report; perchlorate - sample GW-MW025, Boardman AFR Preliminary Assessment/Site Inspection Report TDD:01-08-0006, (Weston Solutions, 2004)

^d Selection of Human Health Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of this SI Report.

[**Bold Face**] - Result exceeds "3x" Maximum Concentration from Media Background Sample

< - less than indicated value

Abbreviations and Acronyms

ft bgs = feet below ground surface

REG = regular sample

PGE - Portland General Electric

ug/kg - micrograms per kilogram

Validation Qualifier Definitions

J = The compound or analyte was positively identified but the reported value is estimated.

R = The reported sample results are rejected because of one of the following: severe deficiencies in the supporting quality control data; anomalies noted in the sampling and/or analysis process which could affect the validity of the reported data; the presence or absence of the constituent cannot be verified based on the data provided; to indicate not to use a particular result in the event of a reanalysis.

U = The compound or analyte was analyzed for but not detected above the associated reporting limit.

UJ = The compound or analyte was analyzed for but not detected above the established reporting limit. However, review and evaluation of supporting QC data and/or sampling and analysis process have indicated that the reporting limit may be inaccurate or imprecise. The nondetect result should be estimated.

**Table 5-1
Comparison of Target No. 2 Soil Analytical Detections to
Background, Human Health and Ecological Screening Values^a
Boardman Air Force Range**

Location						030A002		030A003		PA/SI Sample ^b							
Sample Date						27-Feb-07		28-Feb-07		23-Jun-04		23-Jun-04		23-Jun-04		23-Jun-04	
Sample Number						NWO-030-0002		NWO-030-0003		SS-PS-003-0000		SB-PS-003-0015		SS-PS-005-0000		SB-PS-005-0015	
Sample Depth (ft bgs)						0 to 0.5		0 to 0.5		0 to 0.5		0.5 to 2.0		0 to 0.5		0.5 to 2.0	
Sample Purpose						REG		REG		REG		REG		REG		REG	
Fraction	Parameter	Units	Site Inspection Background 95th UTL / 95th Percentile	Site Inspection Ecological Screening Levels ^a	Human Health Screening Levels EPA Region 9 PRGs - Residential Soil	Result	Validation Qualifier	Result	Validation Qualifier	Result	Validation Qualifier	Result	Validation Qualifier	Result	Validation Qualifier	Result	Validation Qualifier
Metals	Aluminum	mg/kg	21900	50	76000	<i>6690</i>		<i>6400</i>		<i>6120</i>		<i>6270</i>		<i>6150</i>		<i>6840</i>	
Metals	Chromium	mg/kg	26.1	0.4	210	<i>10.2</i>		<i>10.2</i>		<i>8.1</i>		<i>8.4</i>		<i>8.9</i>		<i>9.1</i>	
Metals	Copper	mg/kg	33	50	3100	10		8.4		10.6		12		13.7		13.5	
Metals	Iron	mg/kg	36900	10	23000	<i>19200</i>		<i>19200</i>		<i>16400</i>		<i>16500</i>		<u>24500</u>		<i>18400</i>	
Metals	Lead	mg/kg	17.7	16	400	4.7		3.9		4.4		4		5.2		4.3	
Metals	Mercury	mg/kg	0.036	0.1	23	0.0051	J	0.0057	J	NA		NA		NA		NA	
Metals	Nickel	mg/kg	20.3	30	1600	9.7		8.5		8.3		9.2		9.6		9	

Notes

^a Selection of Ecological Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of this SI Report.

^b Boardman Air Force Range FUDS Preliminary Assessment/Site Inspection Report, TDD: 01-08-0006, Weston Solutions for U.S. EPA Region X, September, 2004.

[**Bold**] - Result exceeds Site Inspection Background 95th UTL / 95th Percentile

[*Italicized*] - Result exceeds Site Inspection Ecological Screening Level

[Underline] - Result exceeds EPA Region 9 PRG - Residential Soil

Abbreviations and Acronyms

ft bgs = feet below ground surface
mg/kg = milligram per kilogram
PRG = Preliminary Remediation Goal
REG = regular sample
UTL = upper tolerance limit

Validation Qualifier Definitions

J = The compound or analyte was positively identified but the reported value is estimated.

R = The reported sample results are rejected because of one of the following: severe deficiencies in the supporting quality control data; anomalies noted in the sampling and/or analysis process which could affect the validity of the reported data; the presence or absence of the constituent cannot be verified based on the data provided; to indicate not to use a particular result in the event of a reanalysis.

U = The compound or analyte was analyzed for but not detected above the associated reporting limit.

UJ = The compound or analyte was analyzed for but not detected above the established reporting limit. However, review and evaluation of supporting QC data and/or sampling and analysis process have indicated that the reporting limit may be inaccurate or imprecise. The nondetect result should be estimated.

**Table 5-2
Comparison of Target Area No. 2 Sediment Analytical Detections to
Background, Human Health and Ecological Screening Values
Boardman Air Force Range**

Location							PA/SI Sample ^b	
Sample Date							24-Jun-04	
Sample Number							SD-SC002-0000	
Sample Depth (ft bgs)							0 to 0.5	
Sample Purpose							REG	
Fraction	Parameter	Units	Maximum Concentration from Media Background Sample	"3x" Maximum Concentration from Media Background Sample	Site Inspection Ecological Screening Levels ^a	Human Health Screening Levels EPA Region 9 PRGs - Residential Soil	Result	Validation Qualifier
Metals	Aluminum	mg/kg	10500	31500	280	76000	<i>5620</i>	
Metals	Chromium	mg/kg	13.2	39.6	37	210	8	
Metals	Copper	mg/kg	13.6	40.8	10	3100	9.9	
Metals	Iron	mg/kg	22400	67200	20	23000	<i>16300</i>	
Metals	Lead	mg/kg	7.1	21.3	35	400	4	
Metals	Mercury	mg/kg	.014	.042	0.2	23	NA	
Metals	Nickel	mg/kg	10.9	32.7	18	1600	8.1	

Notes

^a Selection of Ecological Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of this SI Report.

^b Boardman Air Force Range FUDS Preliminary Assessment/Site Inspection Report , TDD: 01-08-0006, Weston Solutions for U.S. EPA Region X, September, 2004.

[**Bold Face**] = Result exceeds "3x" Maximum Concentration from Media Background Sample

[*Italicized*] = Result exceeds Site Inspection Ecological Screening Level

[UNDERLINED] = Result exceeds EPA Region 9 PRG - Residential Soil

Abbreviations and Acronyms

ft bgs = feet below ground surface

mg/kg = milligram per kilogram

PRG = Preliminary Remediation Goal

REG = regular sample

Validation Qualifier Definitions

J = The compound or analyte was positively identified but the reported value is estimated.

R = The reported sample results are rejected because of one of the following: severe deficiencies in the supporting quality control data; anomalies noted in the sampling and/or analysis process which could affect the validity of the reported data; the presence or absence of the constituent cannot be verified based on the data provided; to indicate not to use a particular result in the event of a reanalysis.

U = The compound or analyte was analyzed for but not detected above the associated reporting limit.

UJ = The compound or analyte was analyzed for but not detected above the established reporting limit. However, review and evaluation of supporting QC data and/or sampling and analysis process have indicated that the reporting limit may be inaccurate or imprecise. The nondetect result should be estimated.

Table 6-1
Comparison of Carty Reservoir Bomb Target Soil Analytical Detections to
Background, Human Health, and Ecological Screening Values
Boardman Air Force Range

Location						030A004	030A005			
Sample Date						27-Feb-07	26-Feb-07			
Sample Number						NWO-030-0004	NWO-030-0005			
Sample Depth (ft bgs)						0 to 0.5	0 to 0.5			
Sample Purpose						REG	REG			
Fraction	Parameter	Units	Site Inspection Background 95th UTL / 95th Percentile	Site Inspection Ecological Screening Levels ^a	Human Health Screening Levels EPA Region 9 PRGs - Residential Soil	Result	Validation Qualifier	Result	Validation Qualifier	
Metals	Chromium	mg/kg	26.1	0.4	210	<i>11.3</i>		<i>12.5</i>		
Metals	Copper	mg/kg	33	50	3100	12.9		13		
Metals	Iron	mg/kg	36900	10	23000	<i>20700</i>		<i>20400</i>		
Metals	Lead	mg/kg	17.7	16	400	5.5		6.2		
Metals	Mercury	mg/kg	0.036	0.1	23	0.0056	J	0.0065	J	
Metals	Nickel	mg/kg	20.3	30	1600	11.7		12.3		

Notes

^a Selection of Ecological Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of this SI Report.

[**Bold**] - Result exceeds Site Inspection Background 95th UTL / 95th Percentile

[*Italicized*] - Result exceeds Site Inspection Ecological Screening Level

[Underline] - Result exceeds EPA Region 9 PRG - Residential Soil

Abbreviations and Acronyms

ft bgs = feet below ground surface

mg/kg = milligram per kilogram

PRG = Preliminary Remediation Goal

REG = regular sample

UTL = upper tolerance limit

Validation Qualifier Definitions

J = The compound or analyte was positively identified but the reported value is estimated.

R = The reported sample results are rejected because of one of the following: severe deficiencies in the supporting quality control data; anomalies noted in the sampling and/or analysis process which could affect the validity of the reported data; the presence or absence of the constituent cannot be verified based on the data provided; to indicate not to use a particular result in the event of a reanalysis.

U = The compound or analyte was analyzed for but not detected above the associated reporting limit.

UJ = The compound or analyte was analyzed for but not detected above the established reporting limit. However, review and evaluation of supporting QC data and/or sampling and analysis process have indicated that the reporting limit may be inaccurate or imprecise. The nondetect result should be estimated.

Table 6-2
Comparison of Carty Reservoir Bomb Target Sediment Analytical Detections to
Background, Human Health and Ecological Screening Values
Boardman Air Force Range

Location							030A006		030A006	
Sample Date							27-Feb-07		27-Feb-07	
Sample Number							NWO-030-1001		NWO-030-1003	
Sample Depth (ft bgs)							0 to 0.5		0 to 0.5	
Sample Purpose							REG		FD	
Fraction	Parameter	Units	Maximum Concentration from Media Background Sample	"3x" Maximum Concentration from Media Background Sample	Site Inspection Ecological Screening Levels ^a	Human Health Screening Levels EPA Region 9 PRGs - Residential Soil	Result	Validation Qualifier	Result	Validation Qualifier
Metals	Chromium	mg/kg	13.2	39.6	37	210	12.1		12.3	
Metals	Copper	mg/kg	13.6	40.8	10	3100	15		15.2	
Metals	Iron	mg/kg	22400	67200	20	23000	20400		20900	
Metals	Lead	mg/kg	7.1	21.3	35	400	5.8		6.3	
Metals	Mercury	mg/kg	.014	.042	0.2	23	0.0092	J	0.009	J
Metals	Nickel	mg/kg	10.9	32.7	18	1600	11.9		11.7	

Notes

^a Selection of Ecological Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of this SI Report.

[**Bold Face**] = Result exceeds "3x" Maximum Concentration from Media Background Sample

[*Italicized*] = Result exceeds Site Inspection Ecological Screening Level

[UNDERLINED] = Result exceeds EPA Region 9 PRG - Residential Soil

Abbreviations and Acronyms

ft bgs = feet below ground surface

mg/kg = milligram per kilogram

PRG = Preliminary Remediation Goal

REG = regular sample

Validation Qualifier Definitions

J = The compound or analyte was positively identified but the reported value is estimated.

R = The reported sample results are rejected because of one of the following: severe deficiencies in the supporting quality control data; anomalies noted in the sampling and/or analysis process which could affect the validity of the reported data; the presence or absence of the constituent cannot be verified based on the data provided; to indicate not to use a particular result in the event of a reanalysis.

U = The compound or analyte was analyzed for but not detected above the associated reporting limit.

UJ = The compound or analyte was analyzed for but not detected above the established reporting limit. However, review and evaluation of supporting QC data and/or sampling and analysis process have indicated that the reporting limit may be inaccurate or imprecise. The nondetect result should be estimated.

**Table 7-1
Comparison of INPR Site No. 1 - Range Complex No. 1 Soil Analytical Detections to
Background, Human Health and Ecological Screening Values
Boardman Air Force Range**

Location						PA/SI Sample^b	
Sample Date						23-Jun-04	
Sample Number						SB-PS-002-0015	
Sample Depth (ft bgs)						0.5 to 2.0	
Sample Purpose						REG	
Fraction	Parameter	Units	Site Inspection Background 95th UTL / 95th Percentile	Site Inspection Ecological Screening Level^a	Human Health Screening Levels EPA Region 9 PRGs - Residential Soil	Result	VQ
Metals	Chromium	mg/kg	26.1	0.4	210	8	
Metals	Copper	mg/kg	33	50	3100	11.1	
Metals	Iron	mg/kg	36900	10	23000	<i>18000</i>	
Metals	Lead	mg/kg	17.7	16	400	4.4	
Metals	Mercury	mg/kg	0.036	0.1	23	NA	
Metals	Nickel	mg/kg	20.3	30	1600	8.8	

Notes

^a Selection of Ecological Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of

^b Boardman Air Force Range FUDS Preliminary Assessment/Site Inspection Report, TDD: 01-08-0006, Weston Solutions for

[**Bold**] - Result exceeds Site Inspection Background 95th UTL / 95th Percentile

[*Italicized*] - Result exceeds Site Inspection Ecological Screening Level

[Underline] - Result exceeds EPA Region 9 PRG - Residential Soil

Abbreviations and Acronyms

FD = field duplicate

ft bgs = feet below ground surface

mg/kg = milligram per kilogram

PRG = Preliminary Remediation Goal

REG = regular sample

UTL = upper tolerance limit

VQ = validation qualifier

Validation Qualifier Definitions

J = The compound or analyte was positively identified but the reported value is estimated.

R = The reported sample results are rejected because of one of the following: severe deficiencies in the supporting quality of the reported data; the presence or absence of the constituent cannot be verified based on the data provided; to indicate not to report.

U = The compound or analyte was analyzed for but not detected above the associated reporting limit.

UJ = The compound or analyte was analyzed for but not detected above the established reporting limit. However, review and reporting limit may be inaccurate or imprecise. The nondetect result should be estimated.

**Table 7-2
Comparison of Demolition Area - Range Complex No. 1 Soil Analytical Detections to
Background, Human Health and Ecological Screening Values
Boardman Air Force Range**

Location						030A007		030A008		030A008	
Sample Date						28-Feb-07		28-Feb-07		28-Feb-07	
Sample Number						NWO-030-0006		NWO-030-0007		NWO-030-0013	
Sample Depth (bgs) (ft)						0 to 0.5		0 to 0.5		0 to 0.5	
Sample Purpose						REG		REG		FD	
Fraction	Parameter	Units	Site Inspection Background 95th UTL / 95th Percentile	Site Inspection Ecological Screening Levels ^a	Human Health Screening Levels EPA Region 9 PRGs - Residential Soil	Result	VQ	Result	VQ	Result	VQ
Metals	Chromium	mg/kg	26.1	0.4	210	8.2		<i>10.1</i>		<i>10.5</i>	
Metals	Copper	mg/kg	33	50	3100	20		11		11	
Metals	Iron	mg/kg	36900	10	23000	<i>22000</i>		<i>22900</i>		<i>21800</i>	
Metals	Lead	mg/kg	17.7	16	400	15.3		4.4		4.3	
Metals	Mercury	mg/kg	0.036	0.1	23	0.0042	J	0.0072	J	0.0045	J
Metals	Nickel	mg/kg	20.3	30	1600	8.7		9.3		9.1	

Notes

^a Selection of Ecological Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of this SI Report.

[**Bold**] - Result exceeds Site Inspection Background 95th UTL / 95th Percentile

[*Italicized*] - Result exceeds Site Inspection Ecological Screening Level

[Underline] - Result exceeds EPA Region 9 PRG - Residential Soil

Abbreviations and Acronyms

FD = field duplicate

ft bgs = feet below ground surface

mg/kg = milligram per kilogram

PRG = Preliminary Remediation Goal

REG = regular sample

UTL = upper tolerance limit

VQ = validation qualifier

Validation Qualifier Definitions

J = The compound or analyte was positively identified but the reported value is estimated.

R = The reported sample results are rejected because of one of the following: severe deficiencies in the supporting quality control data; anomalies noted in the sampling and/or analysis process which could affect the validity of the reported data; the presence or absence of the constituent cannot be verified based on the data provided; to indicate not to use a particular result in the event of a reanalysis.

U = The compound or analyte was analyzed for but not detected above the associated reporting limit.

UJ = The compound or analyte was analyzed for but not detected above the established reporting limit. However, review and evaluation of supporting QC data and/or sampling and analysis process have indicated that the reporting limit may be inaccurate or imprecise. The nondetect result should be estimated.

Table 7-3
Comparison of Turret Gunnery Range - Complex No. 1 Soil Analytical Detections to
Background, Human Health and Ecological Screening Values
Boardman Air Force Range

Location						030A009		030A010	
Sample Date						26-Feb-07		27-Feb-07	
Sample Number						NWO-030-0008		NWO-030-0009	
Sample Depth (bgs) (ft)						0 to 0.5		0 to 0.5	
Sample Purpose						REG		REG	
Fraction	Parameter	Units	Site Inspection Background 95th UTL / 95th Percentile	Site Inspection Ecological Screening Levels ^a	Human Health Screening Levels EPA Region 9 PRGs - Residential Soil	Result	Validation Qualifier	Result	Validation Qualifier
Metals	Chromium	mg/kg	26.1	0.4	210	<i>11.4</i>		<i>10.3</i>	
Metals	Copper	mg/kg	33	50	3100	9.1		8.1	
Metals	Iron	mg/kg	36900	10	23000	<i>17300</i>		<i>17200</i>	
Metals	Lead	mg/kg	17.7	16	400	4.7		3.9	
Metals	Mercury	mg/kg	0.036	0.1	23	0.0069	J	0.0046	J
Metals	Nickel	mg/kg	20.3	30	1600	9.8		8.7	

Notes

^a Selection of Ecological Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of this SI Report.

[**Bold**] - Result exceeds Site Inspection Background 95th UTL / 95th Percentile

[*Italicized*] - Result exceeds Site Inspection Ecological Screening Level

[Underline] - Result exceeds EPA Region 9 PRG - Residential Soil

Abbreviations and Acronyms

ft bgs = feet below ground surface

mg/kg = milligram per kilogram

PRG = Preliminary Remediation Goal

REG = regular sample

UTL = upper tolerance limit

Validation Qualifier Definitions

J = The compound or analyte was positively identified but the reported value is estimated.

R = The reported sample results are rejected because of one of the following: severe deficiencies in the supporting quality control data; anomalies noted in the sampling and/or analysis process which could affect the validity of the reported data; the presence or absence of the constituent cannot be verified based on the data provided; to indicate not to use a particular result in the event of a reanalysis.

U = The compound or analyte was analyzed for but not detected above the associated reporting limit.

UJ = The compound or analyte was analyzed for but not detected above the established reporting limit. However, review and evaluation of supporting QC data and/or sampling and analysis process have indicated that the reporting limit may be inaccurate or imprecise. The nondetect result should be estimated.

Table 8-1
Comparison of Demolition Area No. 2 Soil Analytical Detections to
Background, Human Health and Ecological Screening Values
Boardman Air Force Range

Location						030A011		030A012	
Sample Date						27-Feb-07		27-Feb-07	
Sample Number						NWO-030-0010		NWO-030-0011	
Sample Depth (ft bgs)						0 to 0.5		0 to 0.5	
Sample Purpose						REG		REG	
Fraction	Parameter	Units	Site Inspection Background 95th UTL / 95th Percentile	Site Inspection Ecological Screening Levels ^a	Human Health Screening Levels EPA Region 9 PRGs - Residential Soil	Result	Validation Qualifier	Result	Validation Qualifier
Metals	Chromium	mg/kg	26.1	0.4	210	<i>10.7</i>		<i>12.9</i>	
Metals	Copper	mg/kg	33	50	3100	11.2		15.7	
Metals	Iron	mg/kg	36900	10	23000	<i>17100</i>		<i>22100</i>	
Metals	Lead	mg/kg	17.7	16	400	6.4		6.7	
Metals	Mercury	mg/kg	0.036	0.1	23	0.0065	J	0.0064	J
Metals	Nickel	mg/kg	20.3	30	1600	9		11.5	

Notes

^a Selection of Ecological Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of this SI Report.

[**Bold**] - Result exceeds Site Inspection Background 95th UTL / 95th Percentile

[*Italicized*] - Result exceeds Site Inspection Ecological Screening Level

[Underline] - Result exceeds EPA Region 9 PRG - Residential Soil

Abbreviations and Acronyms

ft bgs = feet below ground surface

mg/kg = milligram per kilogram

PRG = Preliminary Remediation Goal

REG = regular sample

UTL = upper tolerance limit

Validation Qualifier Definitions

J = The compound or analyte was positively identified but the reported value is estimated.

R = The reported sample results are rejected because of one of the following: severe deficiencies in the supporting quality control data; anomalies noted in the sampling and/or analysis process

U = The compound or analyte was analyzed for but not detected above the associated reporting limit.

UJ = The compound or analyte was analyzed for but not detected above the established reporting limit. However, review and evaluation of supporting QC data and/or sampling and analysis process have indicated that the reporting limit may be inaccurate or imprecise. The nondetect result should be estimated.

Table 9-1
Comparison of Impact Area Soil Analytical Detections to
Background, Human Health and Ecological Screening Values
Boardman Air Force Range

Location						030A013	
Sample Date						27-Feb-07	
Sample Number						NWO-030-0012	
Sample Depth (ft bgs)						0 to 0.5	
Sample Purpose						REG	
Fraction	Parameter	Units	Site Inspection Background 95th UTL / 95th Percentile	Site Inspection Ecological Screening Levels^a	Human Health Screening Levels EPA Region 9 PRGs - Residential Soil	Result	Validation Qualifier
Metals	Chromium	mg/kg	26.1	0.4	210	<i>17.5</i>	
Metals	Copper	mg/kg	33	50	3100	18.9	
Metals	Iron	mg/kg	36900	10	23000	<u>29100</u>	
Metals	Lead	mg/kg	17.7	16	400	11.8	
Metals	Mercury	mg/kg	0.036	0.1	23	0.013	J
Metals	Nickel	mg/kg	20.3	30	1600	15	

Notes

^a Selection of Ecological Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of this SI Report.

[**Bold**] - Result exceeds Site Inspection Background 95th UTL / 95th Percentile

[*Italicized*] - Result exceeds Site Inspection Ecological Screening Level

[Underline] - Result exceeds EPA Region 9 PRG - Residential Soil

Abbreviations and Acronyms

ft bgs = feet below ground surface

mg/kg = milligram per kilogram

PRG = Preliminary Remediation Goal

REG = regular sample

UTL = upper tolerance limit

Validation Qualifier Definitions

J = The compound or analyte was positively identified but the reported value is estimated.

R = The reported sample results are rejected because of one of the following: severe deficiencies in the supporting quality control data; anomalies noted in the sampling

U = The compound or analyte was analyzed for but not detected above the associated reporting limit.

UJ = The compound or analyte was analyzed for but not detected above the established reporting limit. However, review and evaluation of supporting QC data and/or sampling and analysis process have indicated that the reporting limit may be inaccurate or imprecise. The nondetect result should be estimated.

Table 9-2
Comparison of Impact Area Sediment Analytical Detections to
Background, Human Health, and Ecological Screening Values
Boardman Air Force Range

Location							030A014	
Sample Date							27-Feb-07	
Sample Number							NWO-030-1002	
Sample Depth (ft bgs)							0 to 0.5	
Sample Purpose							REG	
Fraction	Parameter	Units	Maximum Concentration from Media Background Sample	"3x" Maximum Concentration from Media Background Sample	Site Inspection Ecological Screening Levels^a	Human Health Screening Levels EPA Region 9 PRGs - Residential Soil	Result	Validation Qualifier
Metals	Chromium	mg/kg	13.2	39.6	37	210	15	
Metals	Copper	mg/kg	13.6	40.8	10	3100	<i>15.7</i>	
Metals	Iron	mg/kg	22400	67200	20	23000	<u>23800</u>	
Metals	Lead	mg/kg	7.1	21.3	35	400	8.1	
Metals	Mercury	mg/kg	.014	.042	0.2	23	0.013	J
Metals	Nickel	mg/kg	10.9	32.7	18	1600	12.7	

Notes

^a Selection of Ecological Screening Values is shown in the Final TPP Memorandum (Shaw, 2006) included as Appendix B of this SI Report.

[**Bold Face**] = Result exceeds "3x" Maximum Concentration from Media Background Sample

[*Italicized*] = Result exceeds Site Inspection Ecological Screening Level

[UNDERLINED] = Result exceeds EPA Region 9 PRG - Residential Soil

Abbreviations and Acronyms

ft bgs = feet below ground surface

mg/kg = milligram per kilogram

PRG = Preliminary Remediation Goal

REG = regular sample

Validation Qualifier Definitions

J = The compound or analyte was positively identified but the reported value is estimated.

R = The reported sample results are rejected because of one of the following: severe deficiencies in the supporting quality control data; anomalies noted in the sampling and/or analysis process which could affect the validity of the reported data; the presence or absence of the constituent cannot be verified based on the data provided; to indicate not to use a particular result in the event of a reanalysis.

U = The compound or analyte was analyzed for but not detected above the associated reporting limit.

UJ = The compound or analyte was analyzed for but not detected above the established reporting limit. However, review and evaluation of supporting QC data and/or sampling and analysis process have indicated that the reporting limit may be inaccurate or imprecise. The nondetect result should be estimated.