



Case Study: Remediation of Lead Impacted Soils Former Strathcona Shooting Range, Edmonton

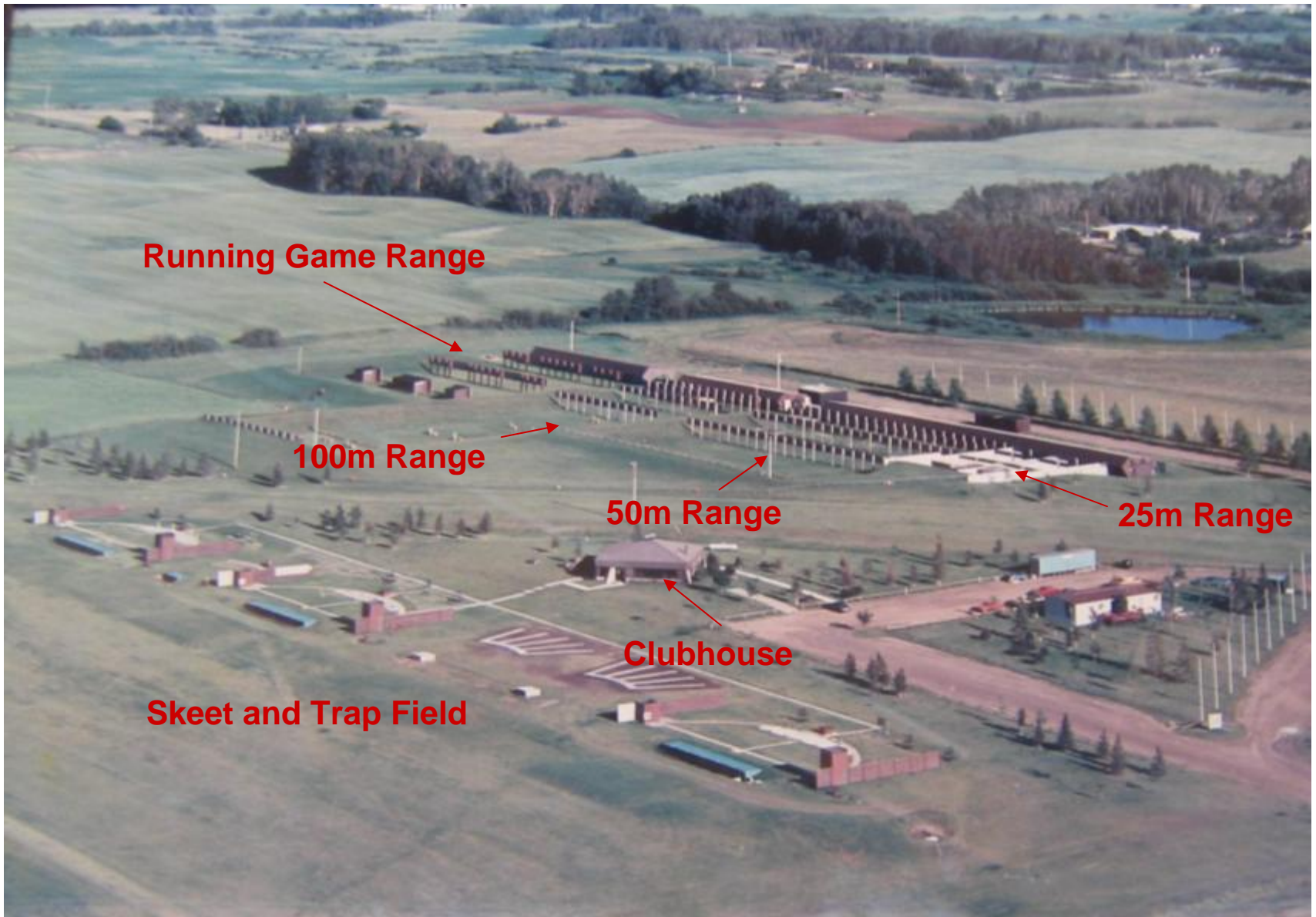
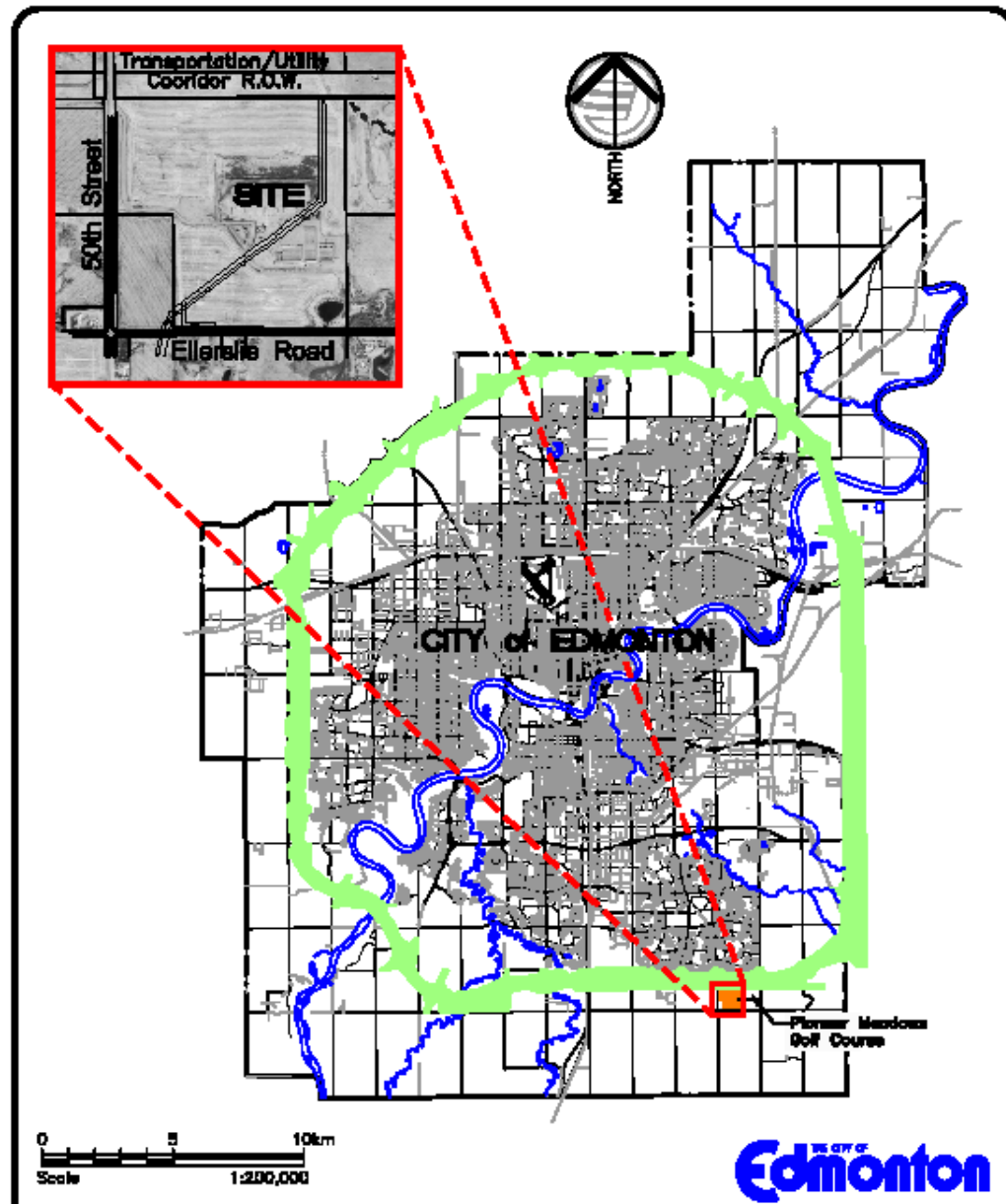


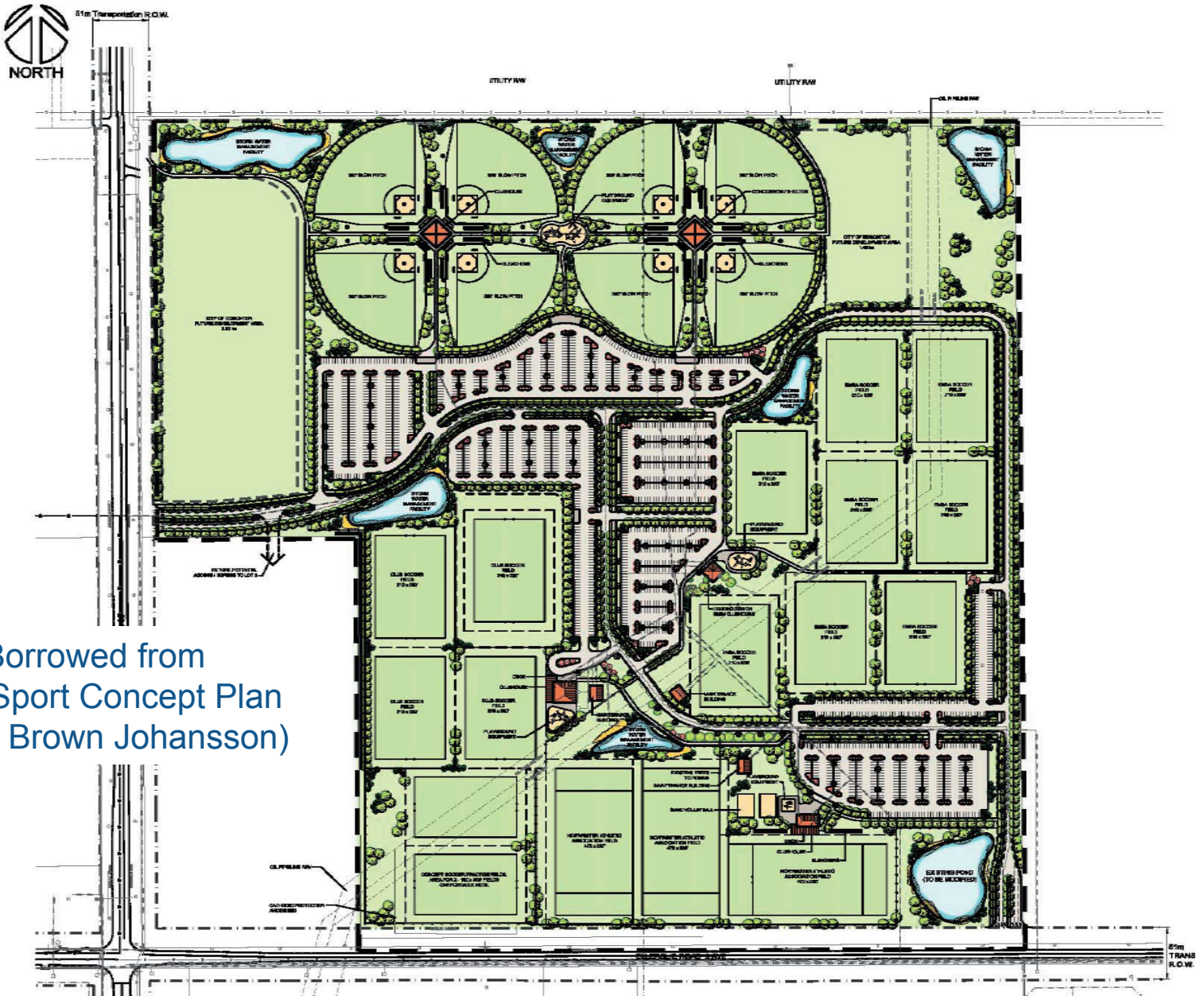
Photo 1: Overview of Strathcona Shooting Range (circa 1988)





Surrounding Land Use Overview

Former Northern Alberta Shooters Association (NASA) Site
Zoned Residential Parkland, Proposed Multi Use Sports Site



Borrowed from
Multi-Sport Concept Plan
(Gibbs Brown Johansson)

History

- **Constructed for 1978 Summer Commonwealth Games**
- **Occupies 64.7 ha (~160 acres) of land**
- **Activities of Skeet, Trap, 25m, 50m, 100m, and Running Game**
- **Main contaminants are lead and PAH's in soil and other heavy metals**
- **Previous studies conducted for 3 years**
- **Groundwater not impacted with dissolved lead**
- **Remediation Action Plan designed to meet CCME**
- **Subsequent release of new AENV Tier 1 Guidelines in 2007 for PAH's (and subsequent 2008 update to AE guidelines).**
- **Implementation of AE Tier 1 caused another 1,151 tonnes of soils to be removed from the skeet fall out area with another 1,090 tonnes removed from the Running Game Range**

Some Facts

- Trap/Skeet Ranges, 90% of ammunition is leadshot
- Contains ~95% lead, & ~2-3% antimony/arsenic alloys
- Assume 50,000 rounds/year at 24 g of Pb/cartridge
- Operate for 30 years = **36 t of scrap lead** in one ha (2.5 acres)
- Up to 30,000 mg/kg (Pb) dry substance in soil
- Clay's are 70% stone powder & 30% Coal Tar Pitch
- PAH's in clays are 5,000 - 25,000 mg/kg
- 50,000 rounds/year x 30 years at 100 g/clay ~ **4.28 t of PAH's**
- Propellant charges, initializing explosives, and wads also contribute to lead residue in soil
- Some soils can be in contact with leadshot and not be affected (Oxidized Rind Effect)

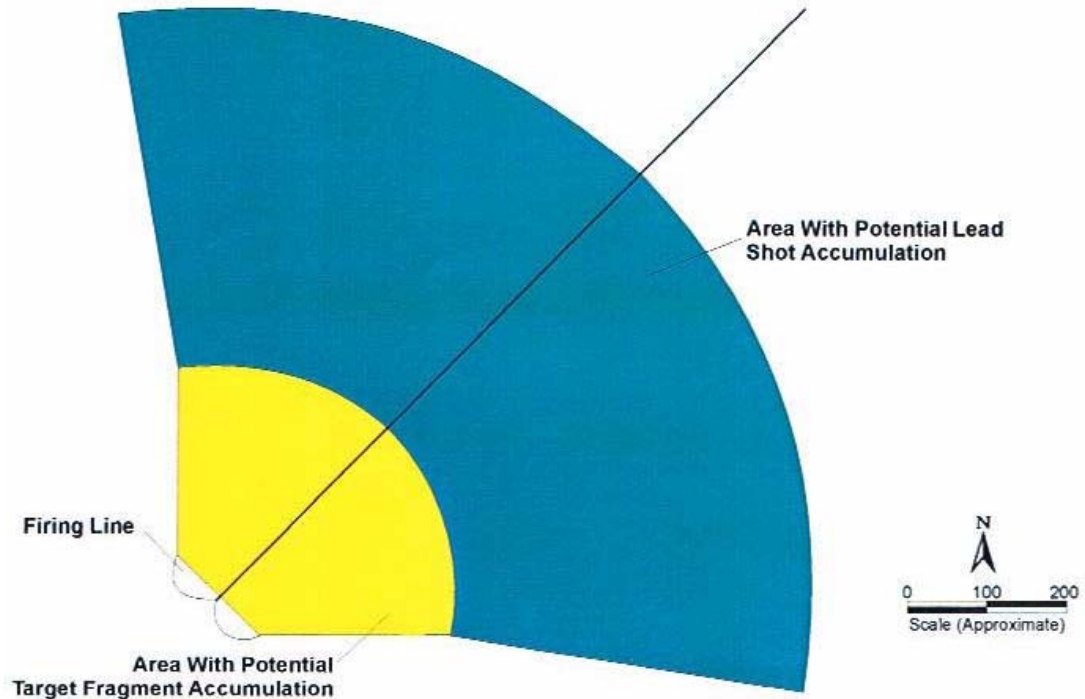
Identification of Data Gaps, Previous Site Work

- Sampling methodologies did not follow any ASTM or EPA protocols
- No survey coordinates for the sample points (data unrepeatability)
- Inability to explain how volume of impacted soils increased substantially between 2004-2006
- Other contaminants associated with shooting ranges other than lead not addressed
- Delineation of the impacted area was not completed
- Total volume of hazardous soils was based on a limited amount of leachate data (less than 1.4% of the total samples submitted for lead)
- No investigation activities on top of pipeline right-of-way
- Soils in the vicinity of creosote treated lumber were not tested for contamination

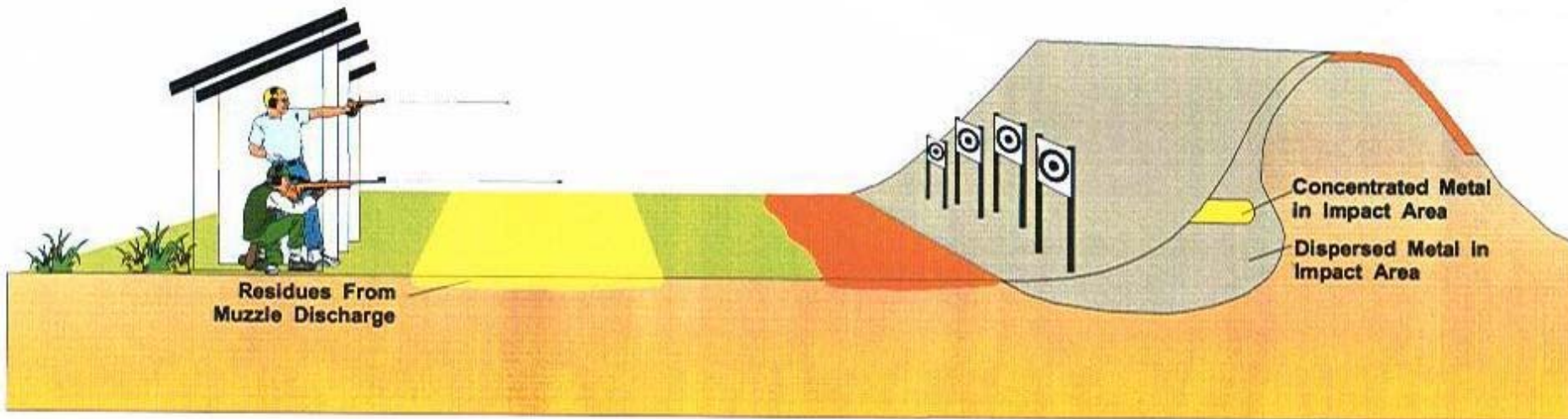


Typical Trap & Skeet (Low Velocity Projectile)

Schematic Cross Sectional View

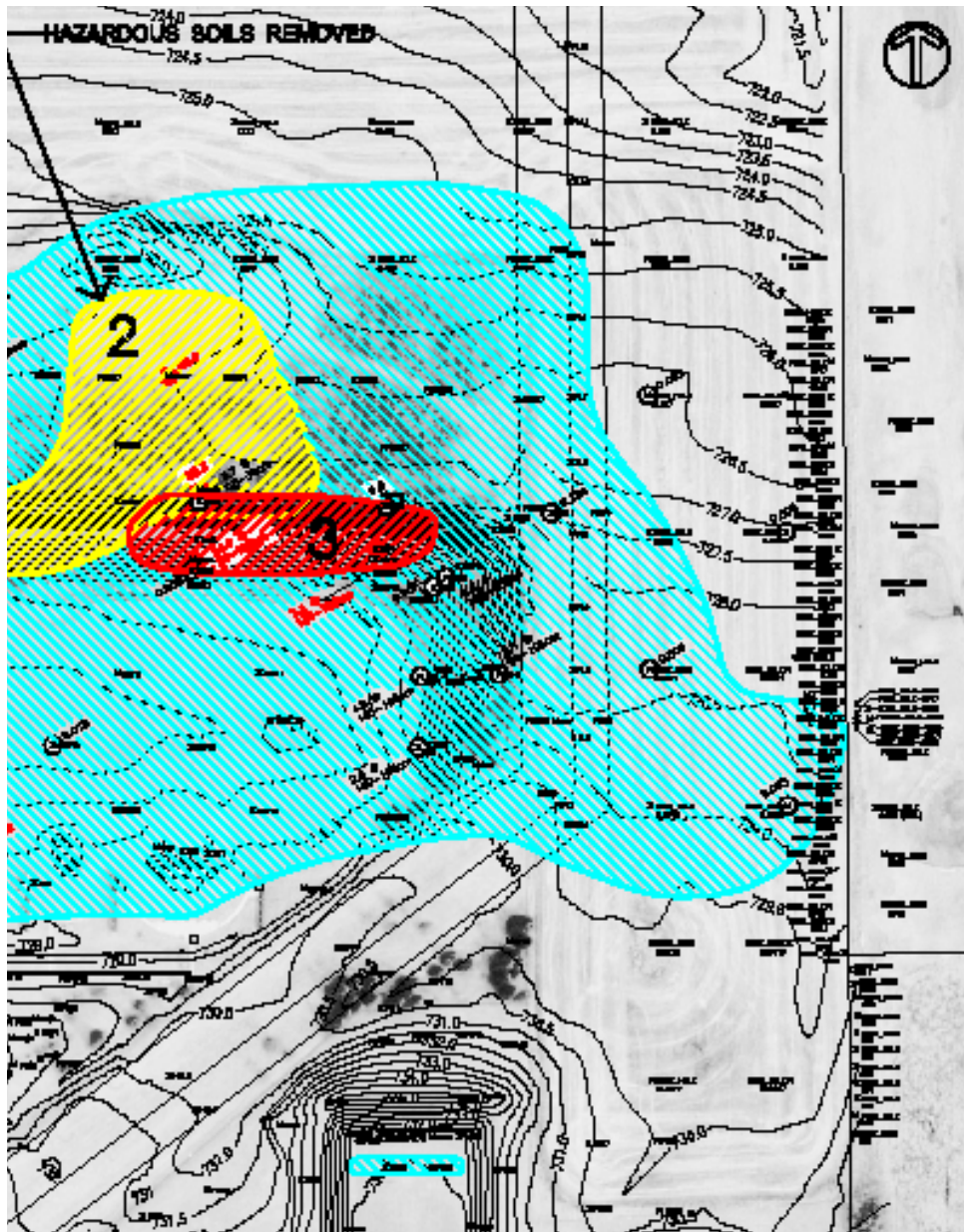


Typical Target (High Velocity Projectile)



- Reviews and Planning Completed
- Time to Complete Work on Site
- A Good Consultant Always Covers Their Butt...

ATTENTION SHOOTERS
THERE ARE CONTRACTORS AND
SURVEYORS ON-SITE.
PLEASE CONTACT SITE ENGINEER
PRIOR TO SHOOTING
982-7365 or 238-1097
THANK YOU



Urgent Phase II ESA of Adjacent Golf Course

- Property transaction pending concern for possible lead impact
- Required immediate defining of plume
- Only limited data available

Investigation Utilizing Direct Push Technology



Investigation For Lead and PAH's

- Shot gun pellets, bullets, primer in shells
- Burned debris, creosote-treated poles
- Skeet's

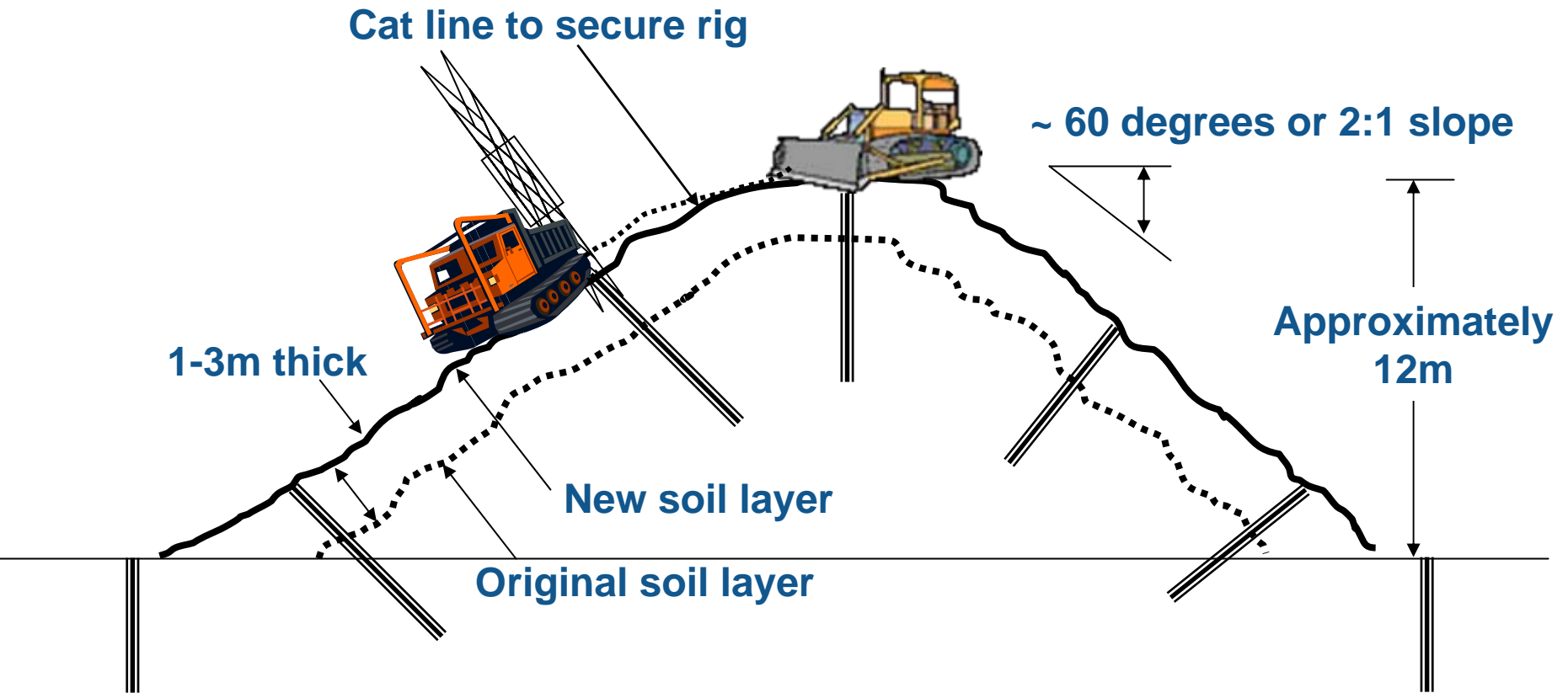


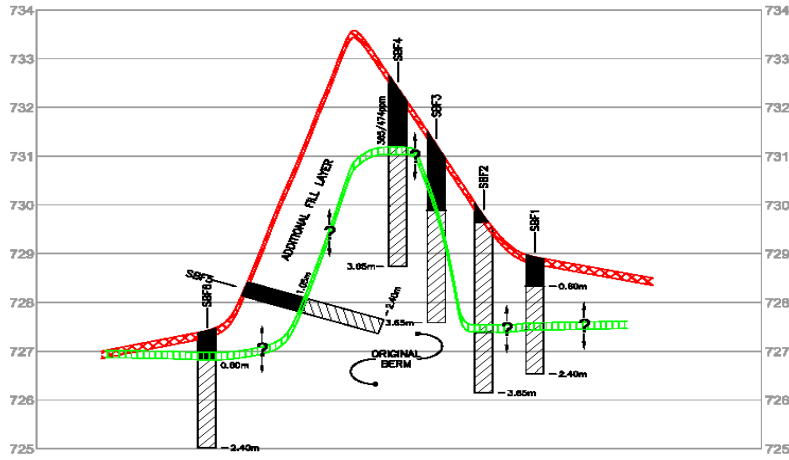
Direct Push and Drilling Challenges

- Snow and frozen ground
- Uneven slippery terrain
- Slopes and worker safety
- Decontamination in cold weather

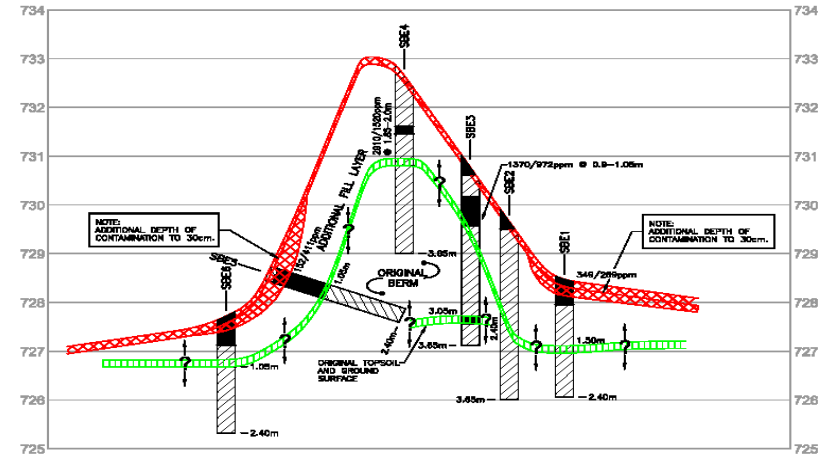


Proposed Schematic: How to Probe Skeet Shooting Berm N.T.S.

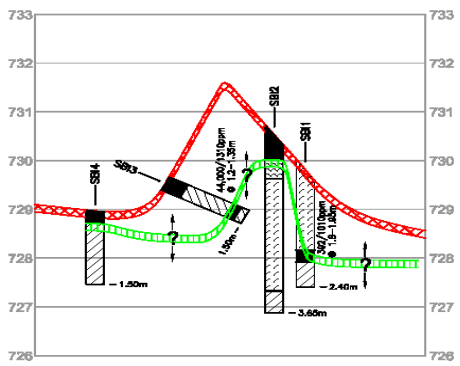




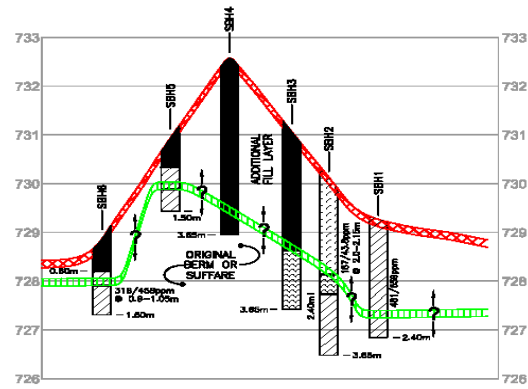
SECTION F
As Noted



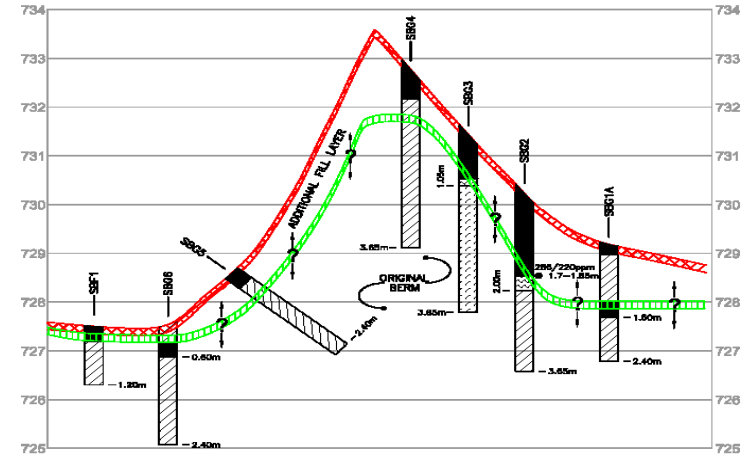
SECTION E
As Noted



SECTION I
As Noted



SECTION H
As Noted

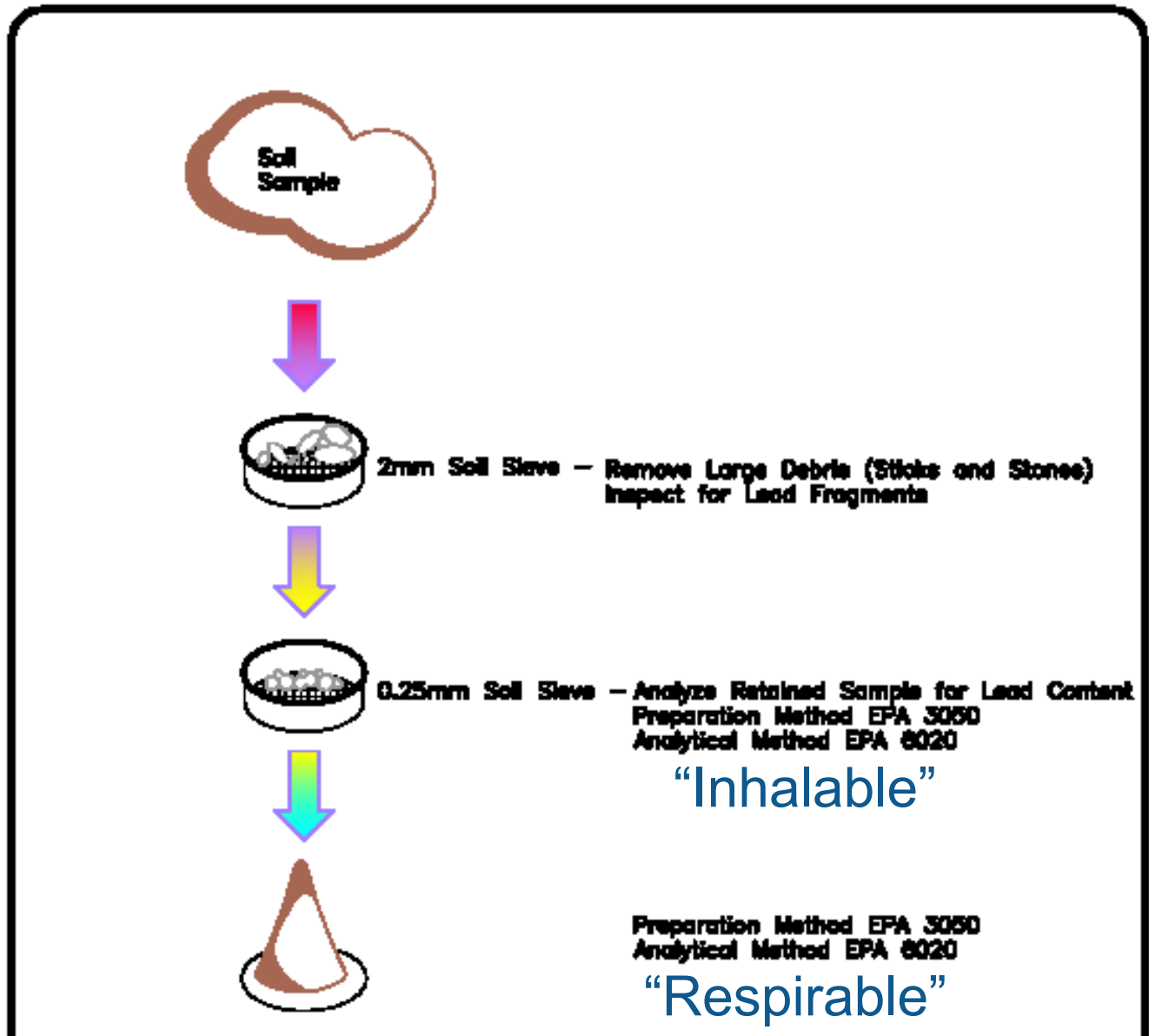


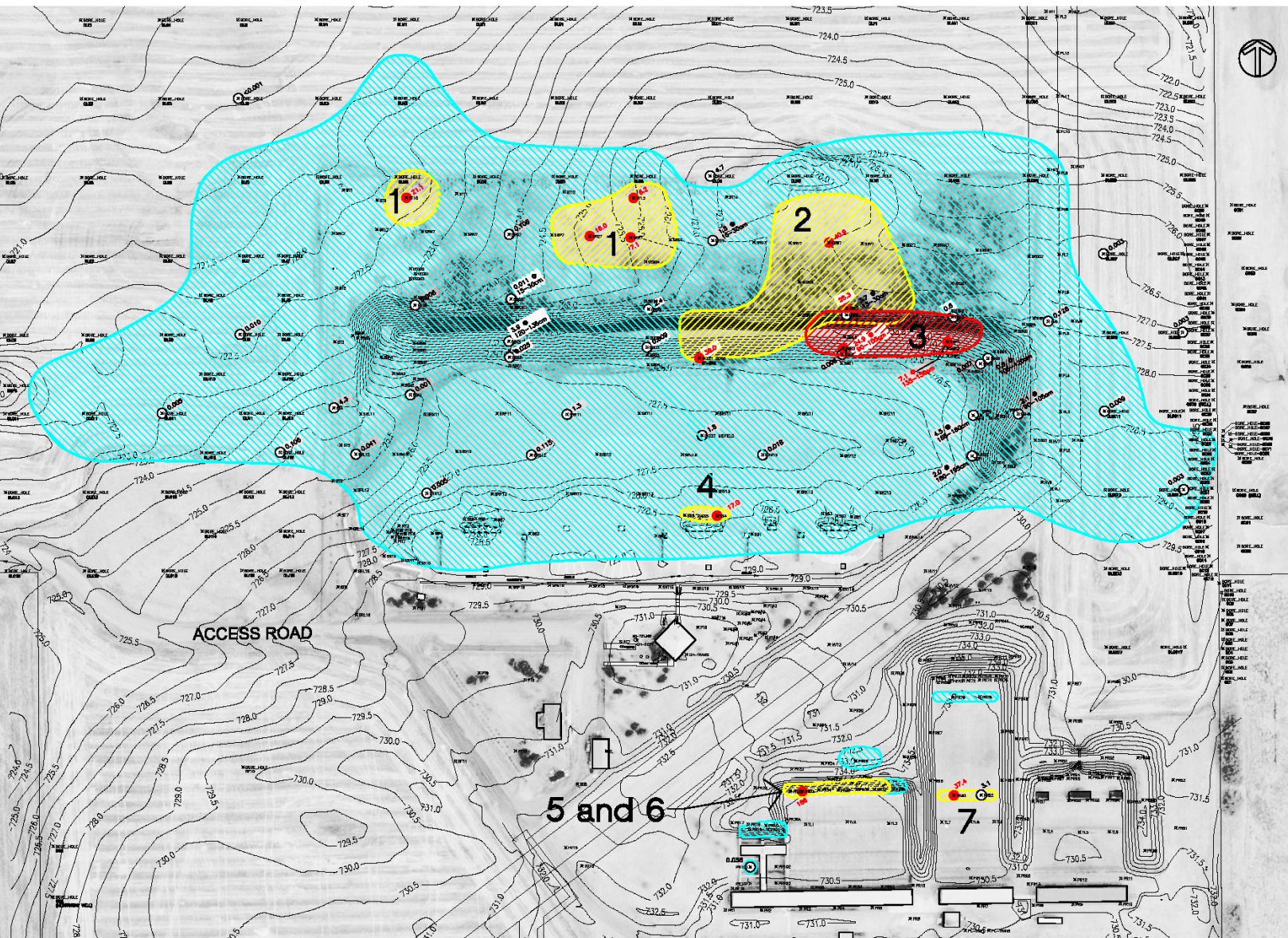
SECTION G
As Noted

Needle in a Hay Stack

- Shot gun pellets within organic layers
- Projectiles (bullets) of all shapes
- Tracking and inventory of samples







Legend

- LEAD TCLP SAMPLE LOCATION
- 0.6 LEAD TCLP CONCENTRATION
- LEAD TCLP EXCEEDANCE
- 21.1 LEAD TCLP CONCENTRATION @ 0-15cm (mg/L) UNLESS NOTED OTHERWISE
- [Blue Hatched Box] CONTAMINATION PLUME (0-15cm)
- [Yellow Hatched Box] HAZARDOUS SOILS PLUME (0-15cm)
- [Red Hatched Box] HAZARDOUS SOILS PLUME (ORIGINAL BERM SURFACE)
- [Black Outline Box] BUILDING STRUCTURE
- 730.0 CONTOUR (INTERNAL 0.5m)

S.T. 1/4 SEC. 20-7p.01-20-94-94M

CALL ALBERTA ONE CALL (1-800-242-3447)

no.	description	date	checked

ISSUED FOR CITY REVIEW	DATE
	07-07-03
ISSUED FOR TENDER	DATE
	07-07-11

PROFESSIONAL ENGINEER

7/11/07

PERMIT TO PRACTICE
EARTH TECH (CANADA) INC.
Signature: [Signature]
Date: July 11, 2007
PERMIT NUMBER: P07502
The Association of Professional Engineers, Geologists and Geotechnical Engineers of Alberta

EarthTech
A tyco International Ltd. Company
17203-100 AVENUE
EDMONTON, ALBERTA
T6E 0Y4
consultant project no. 98580
Tel: (780) 498-4800
Fax: (780) 498-2121
www.earthtech.ca

THE CITY OF Edmonton
ASSET MANAGEMENT AND PUBLIC WORKS

project
**Strathcona Shooting Range
Site Remediation**
location : 50th Street and Ellerslie Road

drawing title
**LIMIT OF
HAZARDOUS SOILS PLAN
SKREET and TRAP**

scale
as dimensioned on this drawing

Vegetation Sampling

- Bark assessment (phloem, cambium, sapwood)
- Core assessment (heartwood)
- Root mass assessment



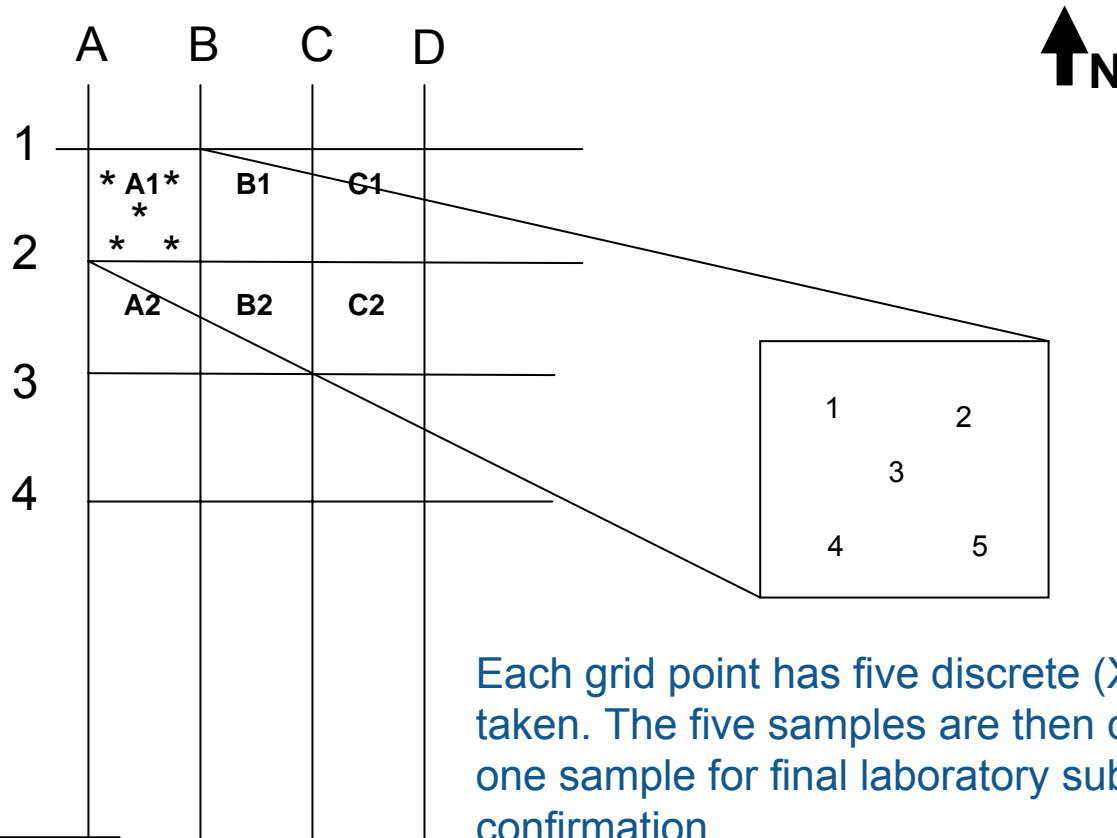


Skeet and Trap Field Excavation Area

Photo 10: Overall view of site showing skeet and trap field excavation area (Summer 2007)



Particulate Sampling Stations (PM10)



Each grid point has five discrete (XRF) reading taken. The five samples are then composited into one sample for final laboratory submission and confirmation.

12 ppm		39 ppm
	14 ppm	
63 ppm		41 ppm

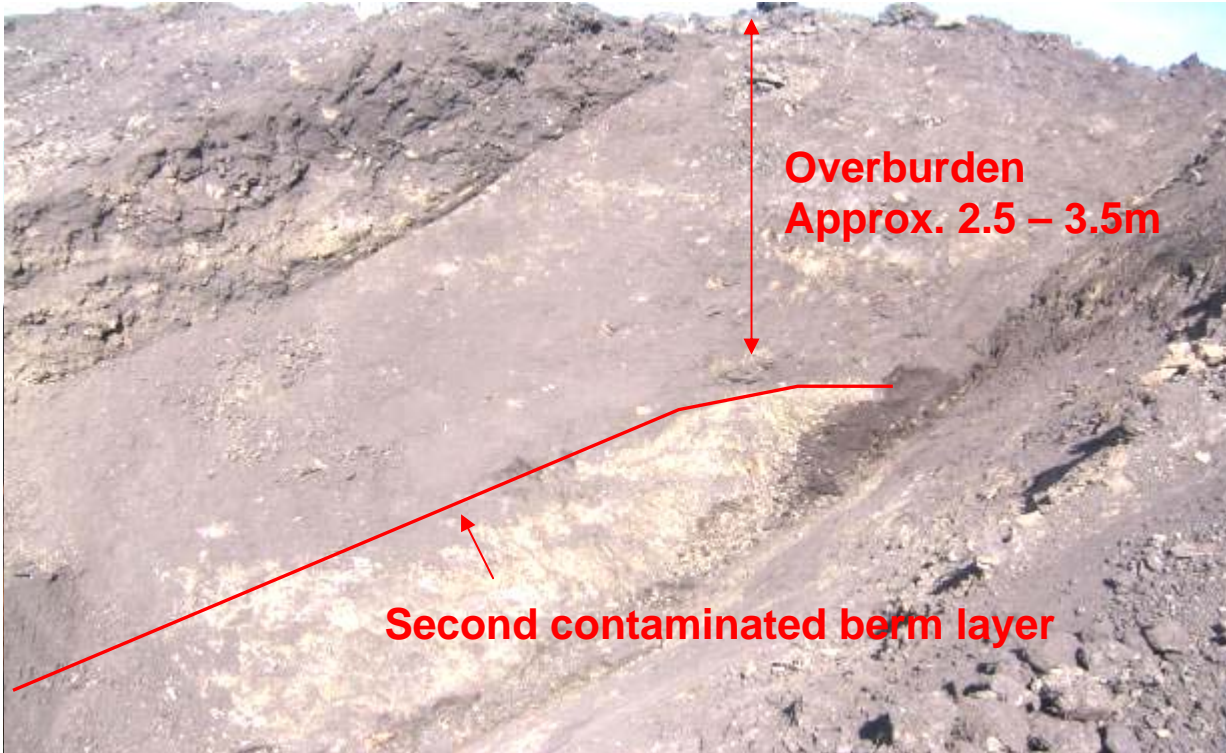
Each grid point has a discrete (XRF) reading recorded. The reading and laboratory composite are then recorded in a reference table - referencing the grid location on a site plan.

Site Remediation Activities









Uncovered Installation of Subgrade Drainage System



Backfilled With Lead and PAH-Impacted Soils



Uncovering of Several Unauthorized Disposal Pits







Dry
←



Crush
→



Sieve
←

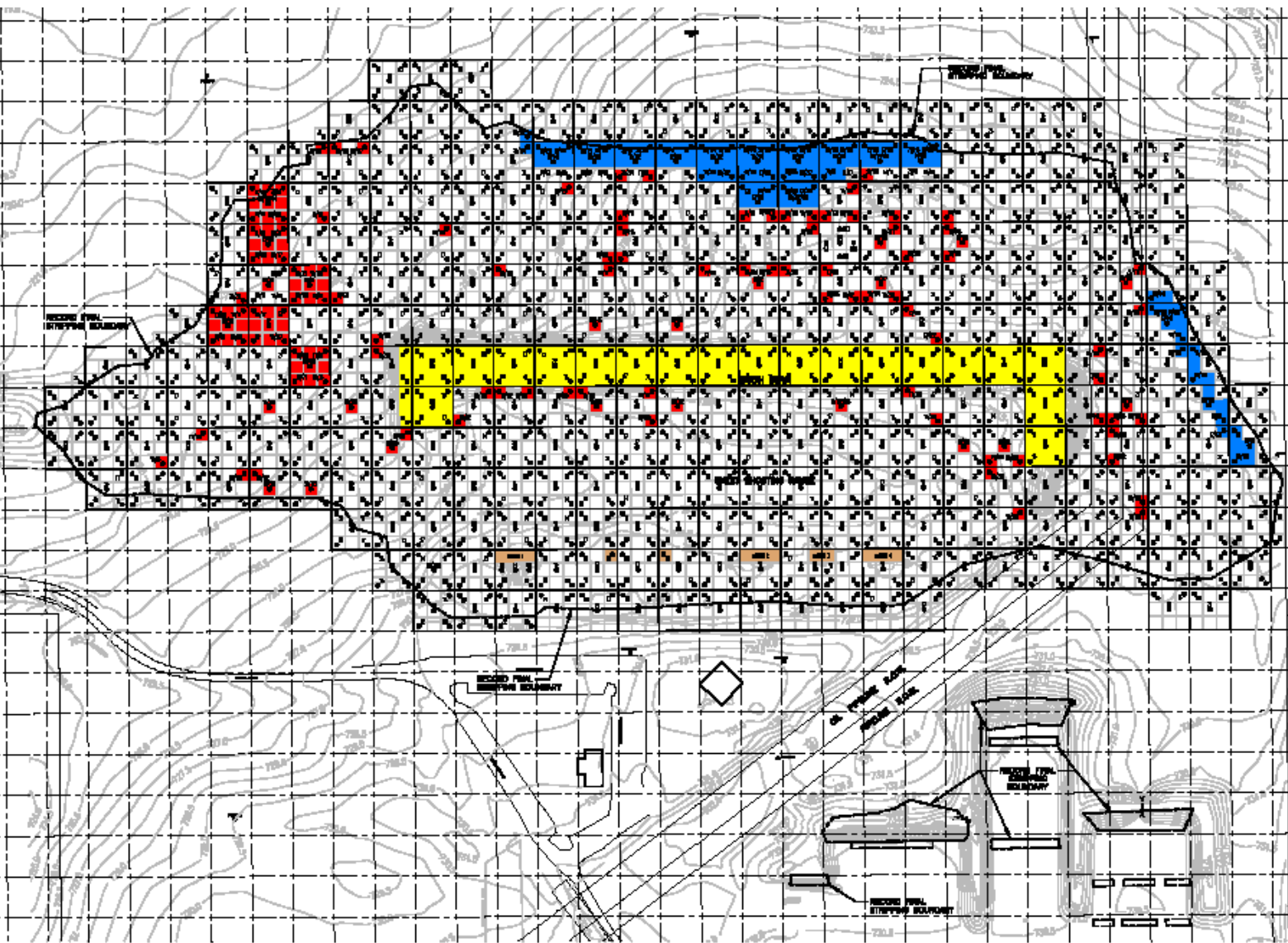


Sample to be analyzed

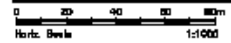
Sticks, stones and unrepresentative debris

→
Prepared Sample





SKET and TRAP FIELD AREA



ALL CONCENTRATIONS IN ppm

Legend:
■ ELEVATED AREA (ELEVATED AREA) 2000 ppm, ADJUSTED REMEDIATION CRITERIA
■ THE MAIN ELEVATED AREA
■ ELEVATED AREA, ELEVATED AREA
■ LOCATION OF RANGE

RECORD DRAWING
CAUTION
 THIS RECORD DRAWING HAS BEEN FORWARDED TO THE AECOM GROUP FOR REVIEW AND APPROVAL. THE AECOM GROUP IS NOT RESPONSIBLE FOR THE ACCURACY OF THE INFORMATION CONTAINED HEREIN. ALL INFORMATION IS BASED ON THE INFORMATION PROVIDED BY THE CLIENT.

EX. 1/4 SHEET-041-024-042

AECOM
 400 ALBERTA DRIVE DALLAS TX 75208
 (214) 645-3443

NO.	REVISION	DATE	BY
1	RECORD DRAWING	08-08-08	MLL
2	REVISION	08-08-08	MLL

DATE FOR CITY REVIEW: 07-07-08
 DATE FOR TOWER: 07-07-11

EarthTech
 10000 17th Street NW
 Redmond, WA 98073
 (206) 881-8800

Geocon ASSET MANAGEMENT AND PUBLIC WORKS

Project: Southoak Shooting Range Site Remediation
Location: 0000 Street and Elkhead Road

Drawing Title: DISCRETE SAMPLE LEAD CONCENTRATIONS (XRF) SKET and TRAP

DATE: 08/08/08
Drawn by: EJC
Checked by: JLD
Reviewed by: JLD
Scale: 1:1000

Sheet No.: 3
Of: 75 SHEETS

DATE: 08/08/08
Project No.: 08R-0000-08-000-DWG

Conclusions

- 58,861 t of Non Haz Soil to Class 2
- 3,151 t of Haz Soil to Class 1
- 472 t of concrete
- 565 t of wood
- 196 t of general debris
- 18 t of metal for recycling
- 1.1 t of hazardous building materials

Total XRF samples = 2,890

Total Lab samples = 559

Conclusions – continued

- Previous remediation estimated to be \$7-9 Million.
-
- The project completed for \$3.4 million in construction costs
- The successful completion required thorough pre-planning and dedication from the City of Edmonton, Earth Tech and Quantum Murray.
- The end result of the project consisted of soils that met Alberta Environment Tier 1 Surface Soil Remediation Guideline Values for Residential/Parkland Land Use as well as Canadian Council of Ministers of the Environment Residential/Parkland criteria for parameters sampled
- The project was completed in June 2008 with no lost time due to injury.

Acknowledgements

- City of Edmonton, Asset Management and Public Works
- Quantum Murray LP
- Bodycote Testing Group
- ALS Laboratory Group
- Maxxam Analytics
- Capital Health
- Alberta Environment