

REFERENCE 32

Maguire, Andrew, GIS Analyst, Ecology and Environment, Inc., April 8, 2009, memorandum to Renee Nordeen, Project Manager, Ecology and Environment, Inc. , regarding calculation of volume for tailings piles at Black Butte Mine, 3 pages.





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MEMORANDUM

REFERENCE 32

DATE: April 8, 2009

TO: Renee Nordeen, Project Manager, Ecology and Environment, Inc., Seattle, WA

FROM: Andrew Maguire, START GIS Analyst, Ecology and Environment, Inc., Seattle, WA *AM*

REF: Technical Direction Document Number: 09-02-0006

SUBJ: Reference 32: Calculation of volume for tailings piles and contaminated soil areas at the Former Mill/Rotary Kiln at Black Butte Mine.

Calculation of tailings pile volumes followed the formula:

$$\text{Volume (yd}^3\text{)} = \text{area (ft}^2\text{)} * \text{average depth of contamination (ft)} / 27$$

The volume of the tailings piles at Black Butte mine are:

- Main Tailings Pile: $365,463.71 * 4 / 27 = 54,142.77 \text{ yd}^3$
- Furnace Creek Tailings Pile = $80,430.31 * 4 / 27 = 11,915.6 \text{ yd}^3$

Area for the Main Tailings Pile was delineated based on maps located in Reference 29.

Area for the Furnace Creek Tailings pile was delineated based on maps located in Reference 20.

A map of the tailings piles is attached. Square Foot (sqft) calculations were made in Zone 10N of the Universal Transverse Mercator (UTM) projection and the North American Datum of 1983 (NAD83) using ArcInfo 9.3 (Environmental Systems Research Institute 2008).

Calculation of the area and volume of contaminated soils at the Former Mill/Rotary Kiln was accomplished by delineating the perimeter to create a polygon around sample locations MK01 – MK06 at the site. Then the perimeter was divided into triangles to facilitate area calculation by Heron's formula:

$$\text{Triangle Area} = \sqrt{s(s - a)(s - b)(s - c)}$$

Where a, b, and c are the length of each side of the triangle, and $s = (a + b + c) / 2$.

Then each triangle is added together to give a final area for the polygon.

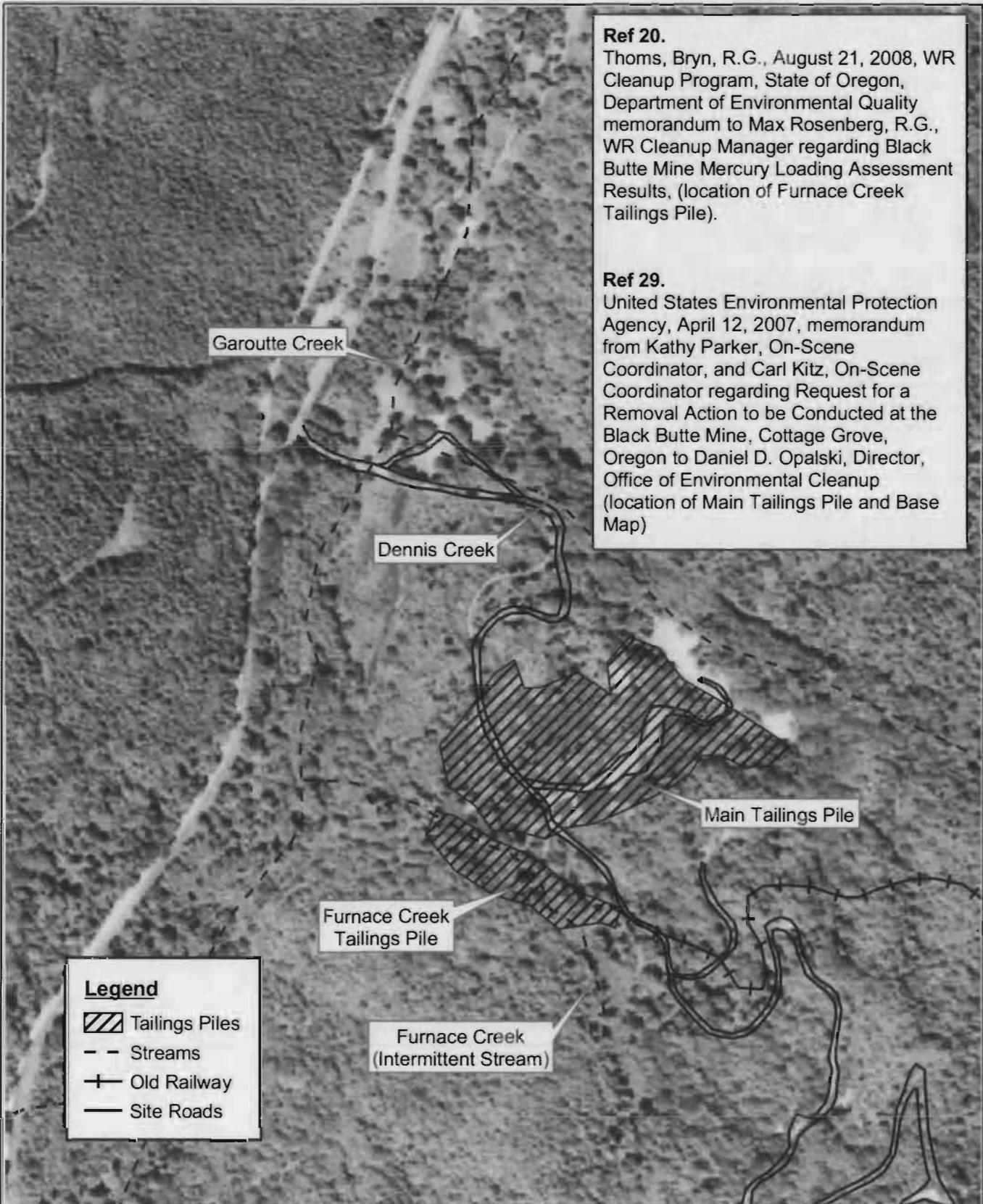
An attached map shows the polygon divided into triangles and the associated lengths.

The area for the contaminated area polygon is:

$$75 \text{ (Triangle 1)} + 137.99 \text{ (Triangle 2)} + 494.11 \text{ (Triangle 3)} + 82.69 \text{ (Triangle 4)} = 789.79 \text{ ft}^2$$

Additionally sample locations MK01 – MK04 associated with Triangles 1 and 2 have a sub-surface depth of 16 in. Therefore a further calculation of volume was calculated by the formula:

$$(75 \text{ (Triangle 1)} + 137.99 \text{ (Triangle 2)}) * 1.33 \text{ (16 in converted to ft)} / 27 = 10.49 \text{ yd}^3$$



Ref 20.

Thoms, Bryn, R.G., August 21, 2008, WR Cleanup Program, State of Oregon, Department of Environmental Quality memorandum to Max Rosenberg, R.G., WR Cleanup Manager regarding Black Butte Mine Mercury Loading Assessment Results, (location of Furnace Creek Tailings Pile).

Ref 29.

United States Environmental Protection Agency, April 12, 2007, memorandum from Kathy Parker, On-Scene Coordinator, and Carl Kitz, On-Scene Coordinator regarding Request for a Removal Action to be Conducted at the Black Butte Mine, Cottage Grove, Oregon to Daniel D. Opalski, Director, Office of Environmental Cleanup (location of Main Tailings Pile and Base Map)

Legend

-  Tailings Piles
-  Streams
-  Old Railway
-  Site Roads



BLACK BUTTE MINE

REFERENCE 32

Lane County, Oregon

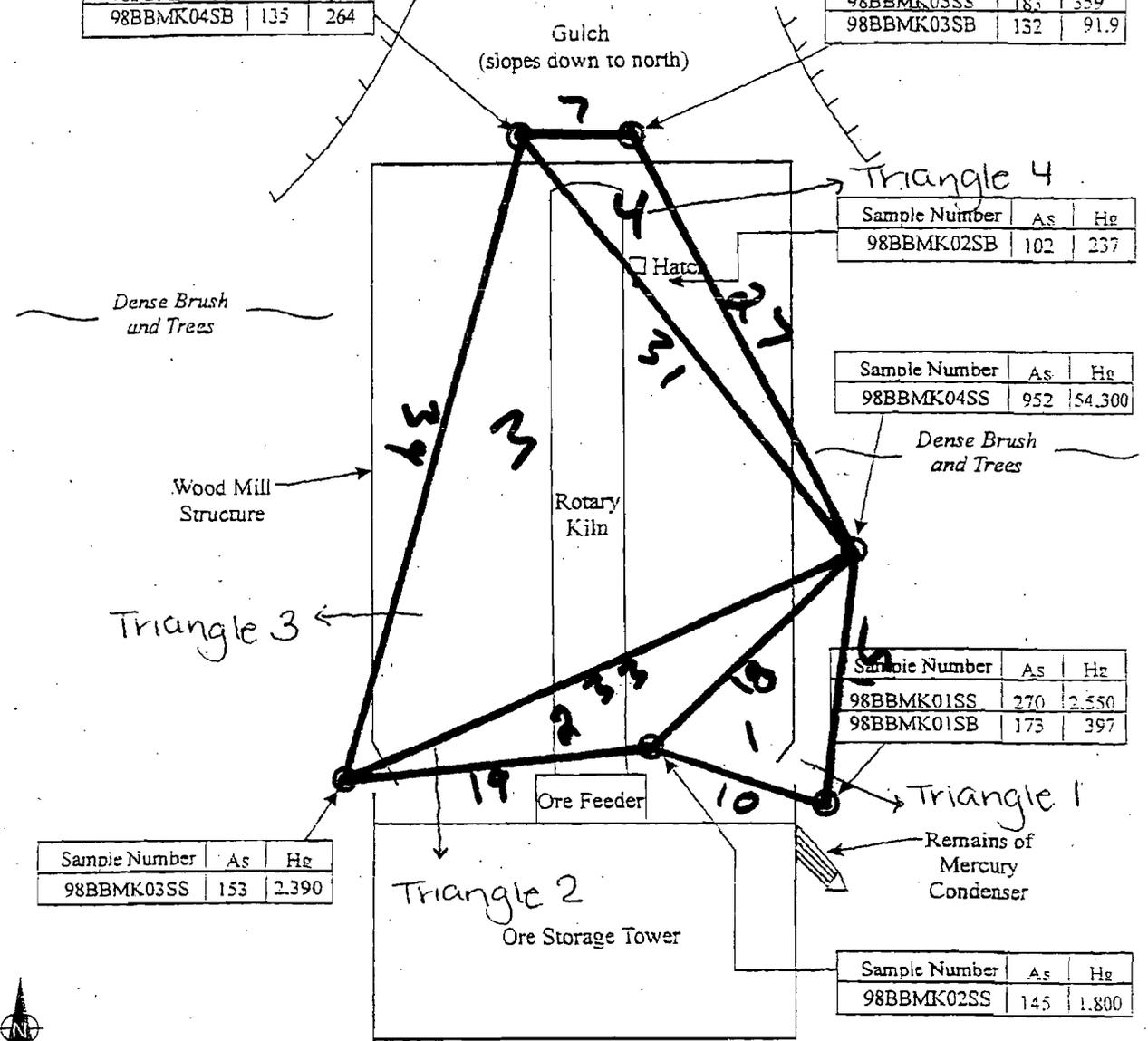
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TDD :
09-02-0006
Date:
4/8/2009
GIS Analyst:
.amm
Map Source Information:
USDA National Aerial Imagery Program, 2006

Map Source: Reference 4, page 44

Sample Number	As	Hg
98BBMK06SS	114	174
98BBMK04SB	135	264

Sample Number	As	Hg
98BBMK05SS	183	359
98BBMK03SB	152	91.9



Sample Number	As	Hg
98BBMK02SB	102	237

Sample Number	As	Hg
98BBMK04SS	952	54,300

Sample Number	As	Hg
98BBMK01SS	270	2,550
98BBMK01SB	173	397

Sample Number	As	Hg
98BBMK03SS	153	2,390

Sample Number	As	Hg
98BBMK02SS	145	1,800

KEY:

- Surface Soil Sample Location
- ⊙ Surface and Subsurface Sample Location
- Subsurface Sample Location
- As Arsenic
- Hg Mercury

NOTE: Listed concentrations are in units of mg/kg

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 Seattle, Washington

BLACK BUTTE MINE SITE
 Cottage Grove, Oregon

Figure 6-2
 FORMER MILL/ROTARY KILN
 SAMPLE LOCATION MAP

0 5 10
 Approximate Scale in Feet

Drawn: AES	DATE: 4/28/99	JOB NO. CD0401SIT0	Dwg. No. CD0401 6-2
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