Name: _____   **Date:** _____

Oil Spill Flow Rate Calculations Worksheet

Directions: Find out how SkyTruth calculated the minimum flow rate of the oil spill on a given day by following these steps:

1. Use Google Earth Pro to measure the area (A) of the oil slick that can be seen from space.
2. Calculate the minimum volume of the slick, in cubic meters (m^3), assuming a depth of 1 micron, or µ.
3. Convert the volume of oil in cubic meters to volume in barrels (V_{bbl}).
4. Calculate the flow rate by dividing the number of barrels of oil leaked by the number of days the well head was leaking.

Step 1) Using the steps outlined in the [Guide to Using Google Earth Pro](), draw a polygon around the oil spill and find the area, A, in square kilometers (km^2) from Google Earth. Record your measurements in the Area column of the Oil Spill Area and Estimated Volume Chart below.

Step 2) Calculate the minimum volume of the spill, in cubic meters, or m^3. Working through the conversions shows that the volume of 1 km^2 at 1 µ = 1 m^3. Therefore, the area you determined in km^2 equals the volume in m^3.

If you want to understand how that calculation works, see the Appendix below.

Regardless, record your values for the Area (km^2) and Estimated Volume (m^3) in the Oil Spill Area and Estimated Volume Chart below.

OIL SPILL AREA AND ESTIMATED VOLUME CHART

date	Area (km^2)	Estimated Volume (m^3)
April 25, 2010		
April 27, 2010		
April 29, 2010		
May 1, 2010		

Step 3) Convert the oil slick volume in cubic meters to slick volume in barrels. To do this, multiply slick volume in cubic meters by the number of liters in a cubic meter (1,000), and then convert that to barrels.

To calculate the number of liters of oil on each day, multiply the number of cubic meters you got in the Estimated Volume above, by 1000. Record your numbers in the "slick volume (L)" column of the Flow Rate Chart.

$$1 \ m^3 = 10 \ X \ 10 \ X \ 10 \ L = 1{,}000 \ L$$

Then convert liters to barrels. Barrels are much larger than liters. Each liter is 0.00628981077 of a barrel. To find the number of barrels on each day, multiply the amount in the "slick volume (L)" column by 0.00628981077. This is the estimated number of barrels seen from space on the surface of the ocean that day. Record your numbers in the "slick volume (bbl)" of the Flow Rate Chart.

Step 4) Calculate the flow rate/per day. The flow rate equals the total number of barrels estimated for that day divided by the number of days the well head had been leaking. (The oil rig exploded on April 20, 2010.)

Flow rate = total V_{bbl} of oil leaked/ number of days leaking

FLOW RATE CHART

date	slick volume (L)	slick volume (bbl)	# of days leaking	flow rate (bbl/# days)
April 25, 2010				
April 27, 2010				
April 29, 2010				
May 1, 2010				

APPENDIX: Why does 1 km² of liquid that is 1 µ deep equal 1 m³ in volume?

To calculate the volume of liquid you multiply the area by the depth.

In this case, because we are using kilometers and microns, there is a convenient trick to finding volume. Here's how it works:

1 km^2 = $1{,}000{,}000 \text{ m}^2$ OR $1 \times 10^6 \text{ m}^2$

1 µ = $\dfrac{1}{1{,}000{,}000} \text{ m}$ OR $1 \times 10^{-6} \text{ m}$

When kilometers and microns are both converted to meters, you can see that when you multiply them together, they equal 1.

$$1{,}000{,}000 \text{ m}^2 \times \frac{1}{1{,}000{,}000} \text{ m} = 1 \text{ m}^3$$

Therefore, the minimum volume on one square kilometer of oil in cubic meters is 1 m³.