PIPELINE PROJECT COST PROJECTION

INTRODUCTION

The company, Neverland-Drilling, Inc., recently acquired Drill Site B. We need to run a pipeline from Drill Site B to the refinery. I have prepared several options illustrating direction of construction and cost of the project with each option. This proposal is limited to cost analysis only. I answer the question of how we can accomplish this project, and not whether we should.

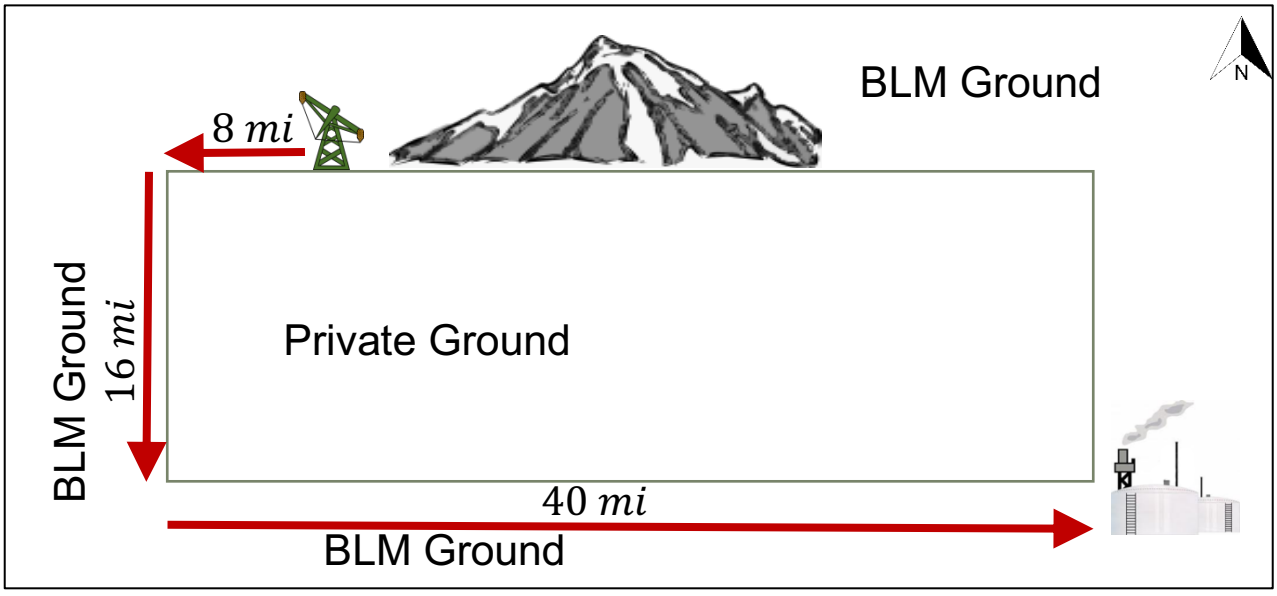
METHOD AND PROCEDURE

I explicitly run through the different options evaluating cost analysis through different routes for your consideration, including all calculations. Option A runs the pipeline strictly on BLM land, thereby avoiding right of way (ROW) fees. Option B runs the pipeline through private land, thereby lessening the cost of materials and time. Option C uses an optimization function to find the most cost efficient way to the refinery from Drill Site B.

OPTION A: BLM LANDS ONLY

ROUTE 1

Run west, south, then east to the refinery.



Fees, materials, and labor (Normal Cost): $\$480{,}000\ per\ mile$

Miles: $8\ mi\ West\ +\ 16\ mi\ South\ +\ 40\ mi\ East\ =\ 64\ mi$

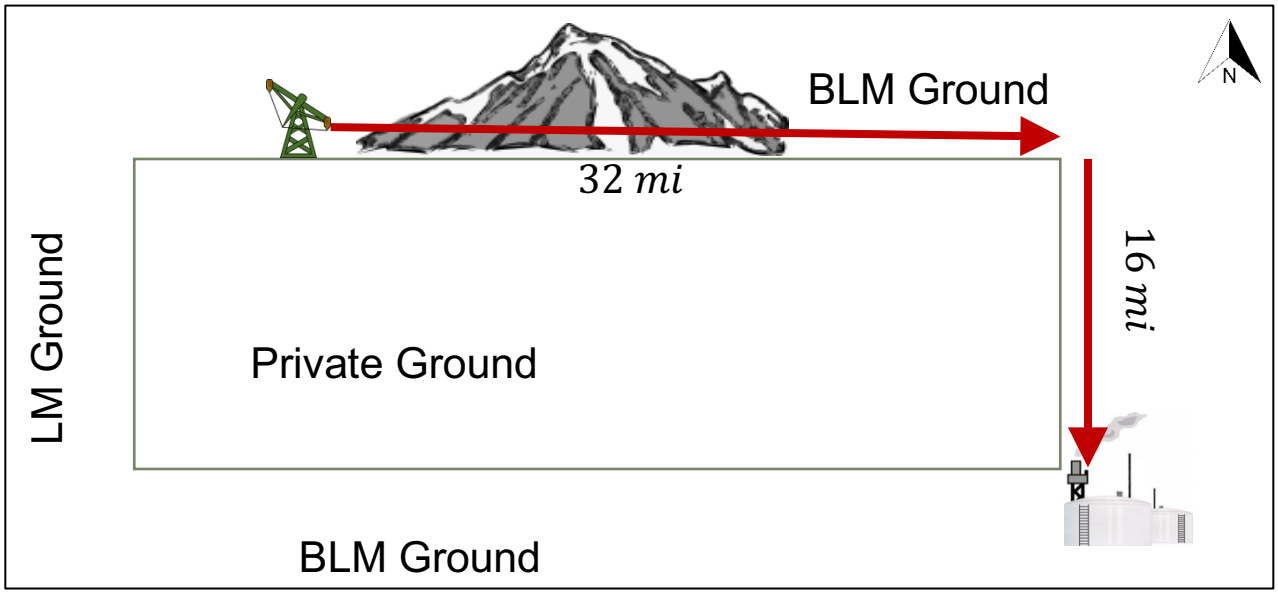
$$Total\ Cost = Normal\ Cost \times miles$$

$$Total\ Cost = \$480{,}000 \times 64\ mi = \$30{,}720{,}000$$

With this option, we run a simple partial perimeter around Private Ground to the Refinery in the direction opposite the mountain, at a cost of $\$30{,}720{,}000$.

ROUTE 2

Run East, go through the mountain, then South to the refinery.



Normal cost: $\$480{,}000\ per\ mi$

Miles: $32\ mi\ East + 16\ mi\ South = 48\ mi$

One-time (OT) cost: $\$4{,}500{,}000$

Environmental Impact (EI) Study: $\$600{,}000\ study, 8\ mo\ delay$

Delay: $\$100{,}000\ per\ mo$

$$Total\ Cost = (Normal\ Cost \times miles) + OT\ Cost + EI\ Study + (Delay \times months)$$

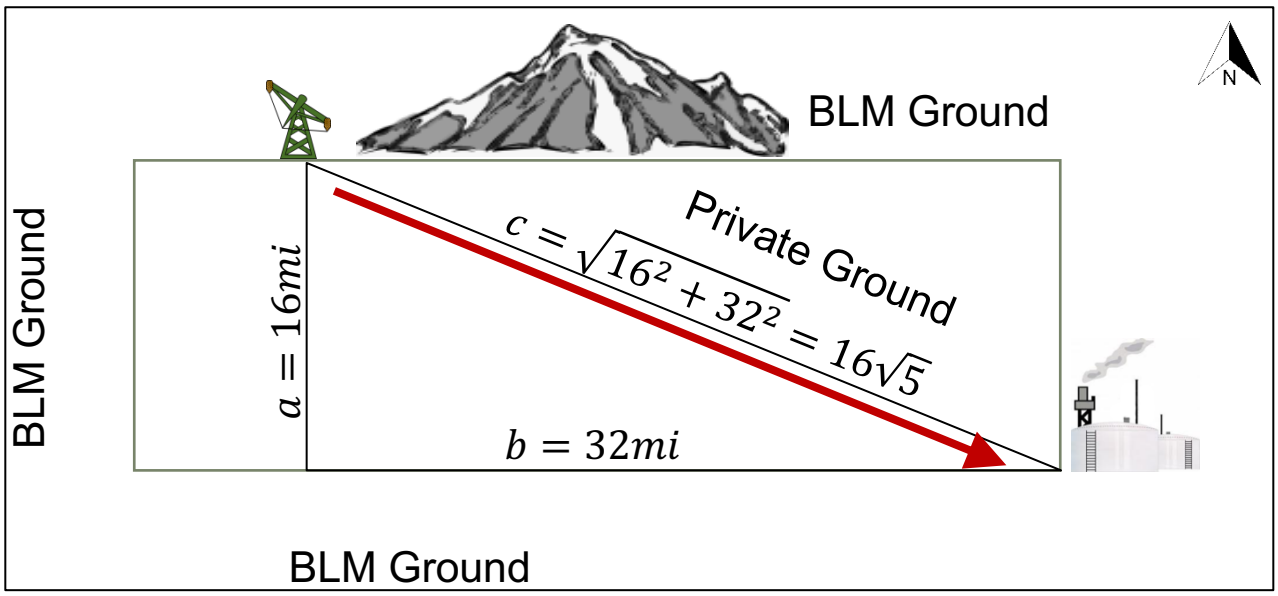
$$Total\ Cost = (\$480{,}000 \times 48) + \$4{,}500{,}000 + \$600{,}000 + (\$100{,}000 \times 8) = \$28{,}940{,}000$$

This option takes us through another partial perimeter, this time going in the opposite direction and through the mountain. Here we account for the cost differential incurred by having to drill (baby, drill) into the mountain, fund an Environmental Impact Study which is required by BLM, and the cost of delaying the project for eight months, which is the minimum estimated time that the Environmental Impact Study requires. Going this route would cost $28,940,000.

OPTION B: CUT THROUGH PRIVATE LAND

ROUTE 3

Run the shortest distance across the private ground to the refinery.



Normal cost: $\$480{,}000\ per\ mi$

Right-of-way (ROW) fee: $\$360{,}000\ per\ mi$

Miles: $16\sqrt{5}\ mi$

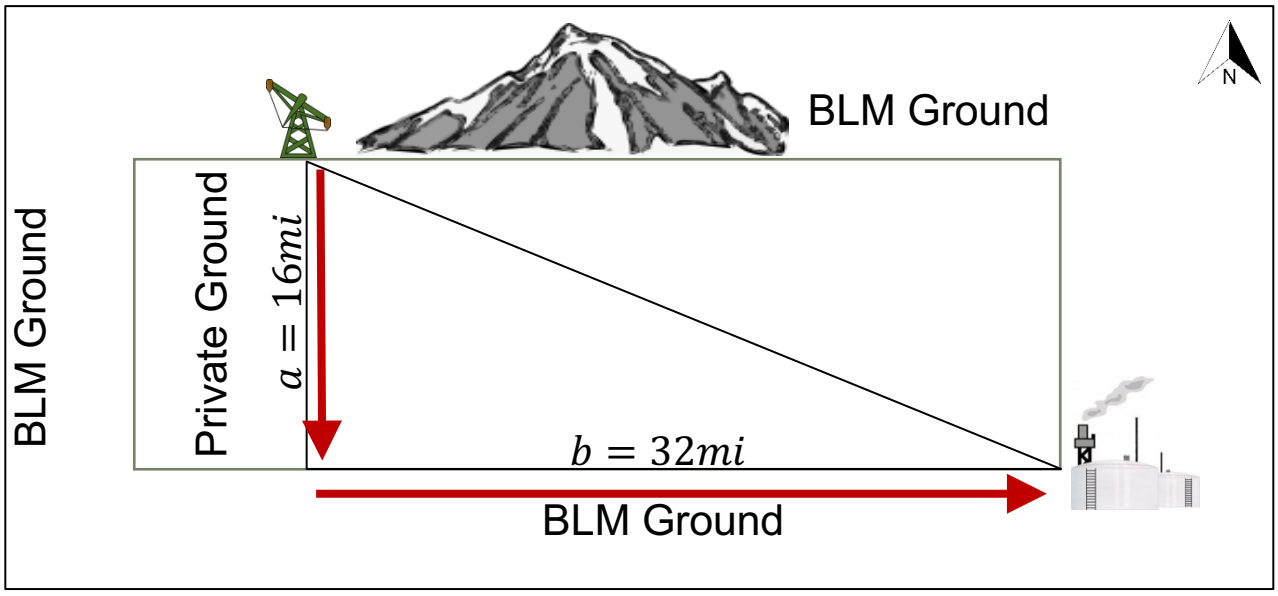
$$Total\ Cost = (Normal\ cost + ROW\ fee) \times Miles$$

$$Total\ Cost = (\$480{,}000 + \$360{,}000) \times 16\sqrt{5} = 13{,}440{,}000\sqrt{5} \approx \$30{,}052{,}753.62$$

This option has us taking the shortest possible route to the Refinery, and completely through Private Ground. Aside from Normal cost, here we must account for the added cost of Right-of-way fees. This route would cost $30,052,754.

ROUTE 4

Run straight South across Private Ground, then straight East to the refinery.



Normal cost: $\$480{,}000\ per\ mi$

ROW fee: $\$360{,}000\ per\ mi$

Miles $_{ROW}$: $16\ mi$

Miles $_{BLM}$: $32\ mi$

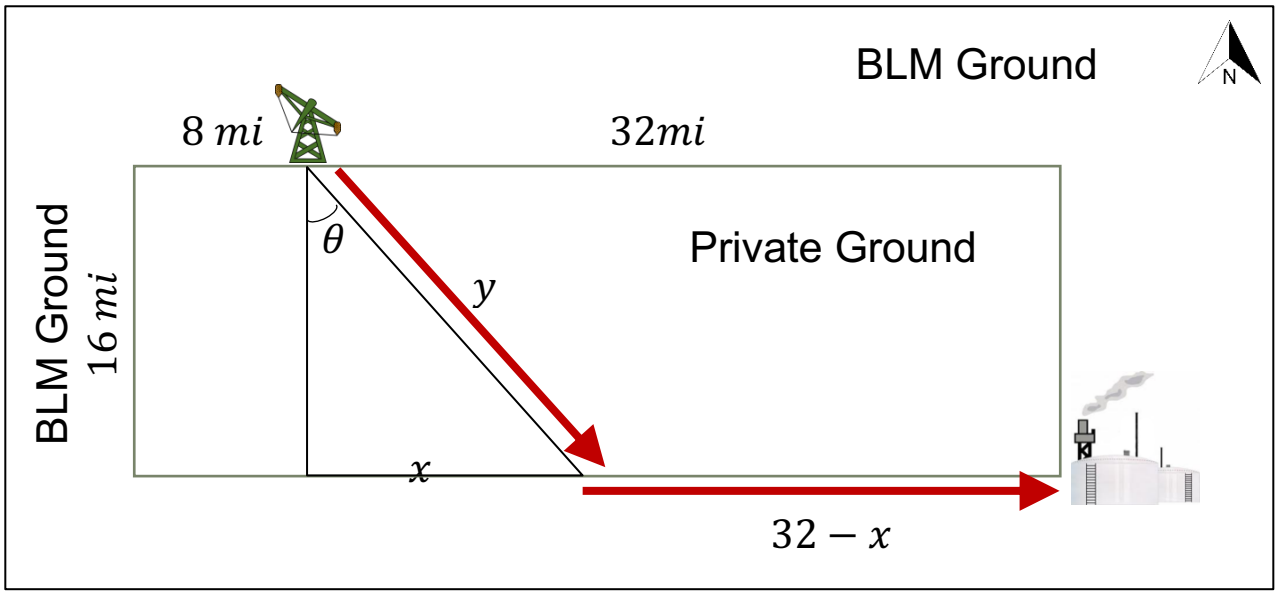
$$Total\ Cost = [(Normal\ cost + ROW\ fee) \times Miles_{ROW}] + [Normal\ cost \times Miles_{BLM}]$$

$$Total\ Cost = [(\$480{,}000 + \$360{,}000) \times 16\ mi] + [\$480{,}000 \times 32\ mi] = \$28{,}800{,}000$$

This option has us taking the shortest possible route through Private Grounds to hopefully cut down on Right-of-way fees, and going the rest of the way to the Refinery on BLM land. This turned out to be our second best option for cutting costs at $28,800,000.

ROUTE 5

Run Southeast from the well at some angle θ, intersect BLM Ground to the South, and then run East to the Refinery.



Formulas for Angle in radians and Distance in miles:

$$tan\theta = \frac{x}{16}$$

$$D_{ROW} = y = \sqrt{x^2 + 16^2} \ \ (arrived\ at\ via\ the\ pythagorean\ theorem)$$

$$D_{BLM} = D = 32 - x$$

Cost Function $C(x)$ in dollars:

$$C(x) = 480{,}000(32 - x) + 840{,}000y$$

Substitute to get one variable:

$$C(x) = 480{,}000(32 - x) + 840{,}000\sqrt{x^2 + 16^2}$$

$$C(x) = 15{,}360{,}000 - 480{,}000x + 840{,}000\sqrt{x^2 + 16^2}$$

The first derivative of $C(x) = C'(x)$, used to find critical points, if any:

$$C'(x) = (-480{,}000) + [840{,}000 \times \frac{1}{2} \times (x^2 + 16^2)^{-\frac{1}{2}} \times 2x]$$

$$C'(x) = \frac{840{,}000x}{\sqrt{x^2 + 16^2}} - 480{,}000$$

Find where $C'(x) = 0$:

$$C'(x) = \frac{840{,}000x}{\sqrt{x^2 + 16^2}} - 480{,}000 = 0$$

$$\frac{840{,}000x}{\sqrt{x^2 + 16^2}} = 480{,}000$$

$$\frac{840{,}000x}{480{,}000} = \sqrt{x^2 + 16^2}$$

$$\frac{840{,}000x}{480{,}000} = \sqrt{x^2 + 16^2}$$

$$\frac{7x}{4} = \sqrt{x^2 + 16^2}$$

$$\frac{49x^2}{16} = x^2 + 16^2$$

$$\frac{49x^2}{16} = x^2 + 16^2$$

$$49x^2 = 16x^2 + 16^3$$

$$33x^2 = 16^3 = 4096$$

$$x^2 = \frac{4096}{33}$$

$$x = \sqrt{\frac{4096}{33}} = \frac{64\sqrt{33}}{33}$$

Find the Angle:

$$tan\theta = \frac{\frac{64\sqrt{33}}{33}}{16} = \frac{4\sqrt{33}}{33}$$

$$\theta = \tan^{-1}\frac{4\sqrt{33}}{33} \approx 0.6082455789\, radians$$

$$\theta = 0.6082455789\, rads \times \frac{180}{\pi} = 34.85°$$

Find Distance (y) across Private Grounds:

$$y = \sqrt{(\frac{64\sqrt{33}}{33})^2 + 16^2} \approx 19.5\, mi$$

Find Distance (D) across BLM Grounds:

$$D = 32 - x$$

$$D = 32 - \frac{64\sqrt{33}}{33}$$

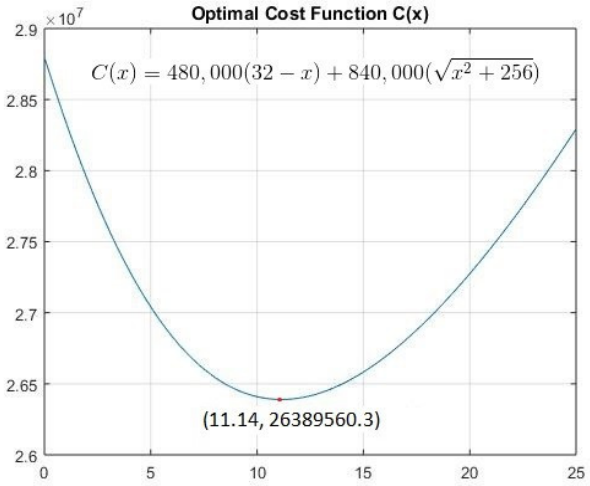
$$D \approx 20.859\, mi$$

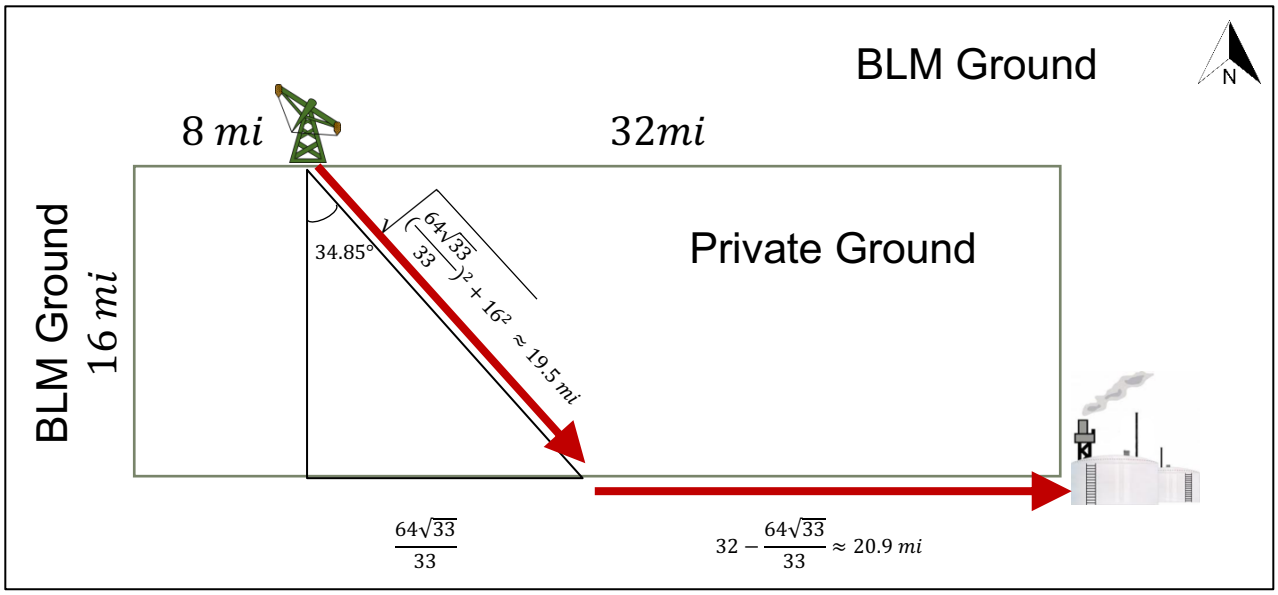
Find minimum cost (C):

$$C = C(x) = 480{,}000(32 - x) + 840{,}000y$$

$$C = 480{,}000\left(32 - \frac{64\sqrt{33}}{33}\right) + 840{,}000\left(\sqrt{(\frac{64\sqrt{33}}{33})^2 + 16^2}\right)$$

$$C = \$26{,}389{,}560.28$$





After using the first derivative of my cost function C(x) to find a critical point, I found that Cost is minimized if we run the pipeline about 34.85 degrees southwest from the well through Private land toward BLM land, then run the pipeline the rest of the way through BLM land. We will build approximately19.5 miles of pipeline on Private Ground, and approximately 20.9 miles of pipeline on BLM land. The minimum possible cost of building this pipeline is $\$26{,}389{,}560.28$, which costs $\$2{,}410{,}439.72$ less than our next best option (Route 4).

CONCLUSION

Route 5 (page 5) proves the most cost effective way to drill in terms of US Dollars. Yet to be determined is the environmental impact of drilling itself and continued investment in fossil fuels; the immediate impact to the local and surrounding population; as well as the traditional significance of the land being drilled and laid upon. These are also important factors of consideration before the company makes its final decision.

CONTACT

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