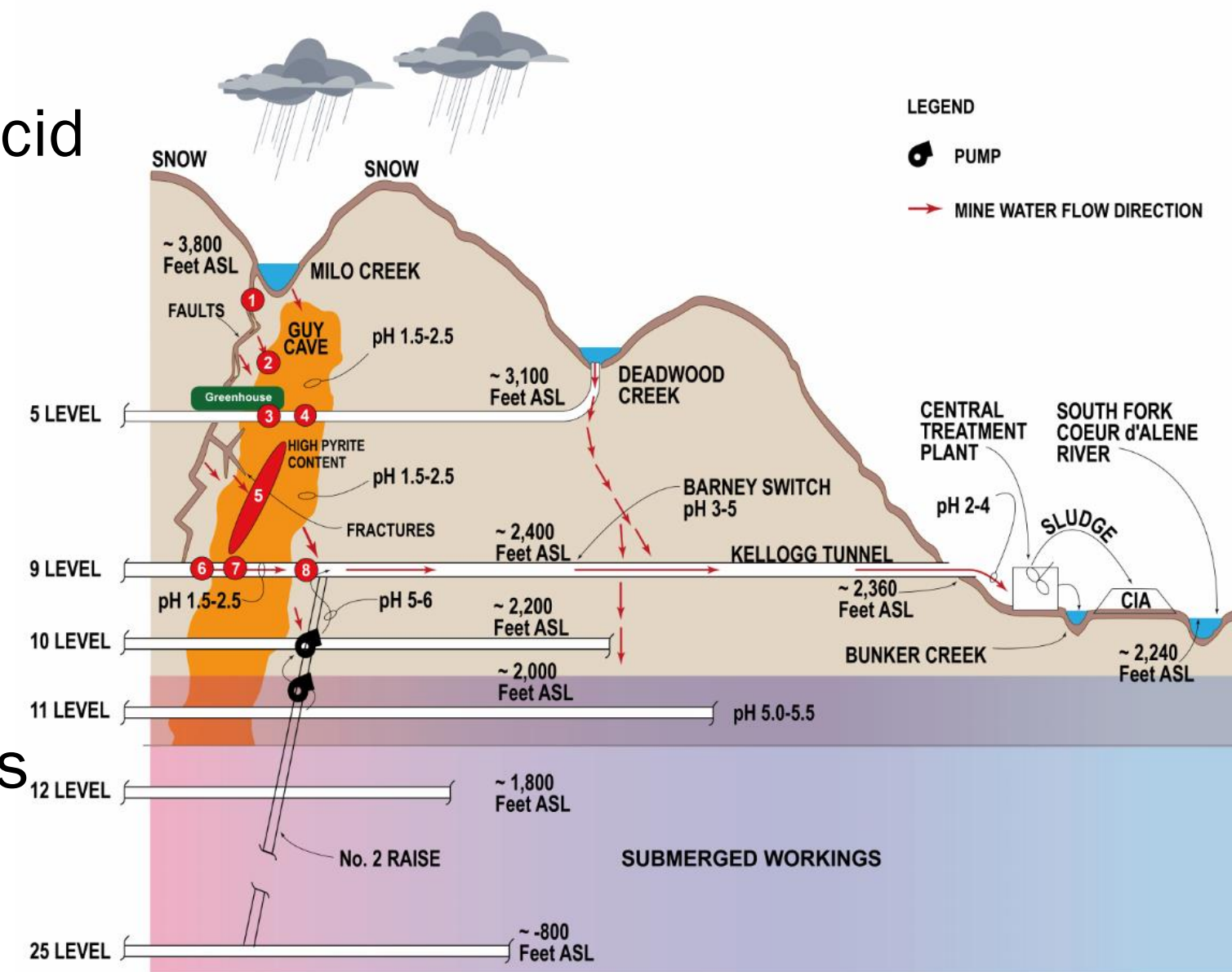


BACKGROUND

- The Bunker Hill mine creates 1,400 gpm of acid mine drainage (AMD).
- Treatment of drainage costs approximately \$1 million annually.
- 90% of AMD load comes from 40 gpm from Guy Cave region (pH=2).



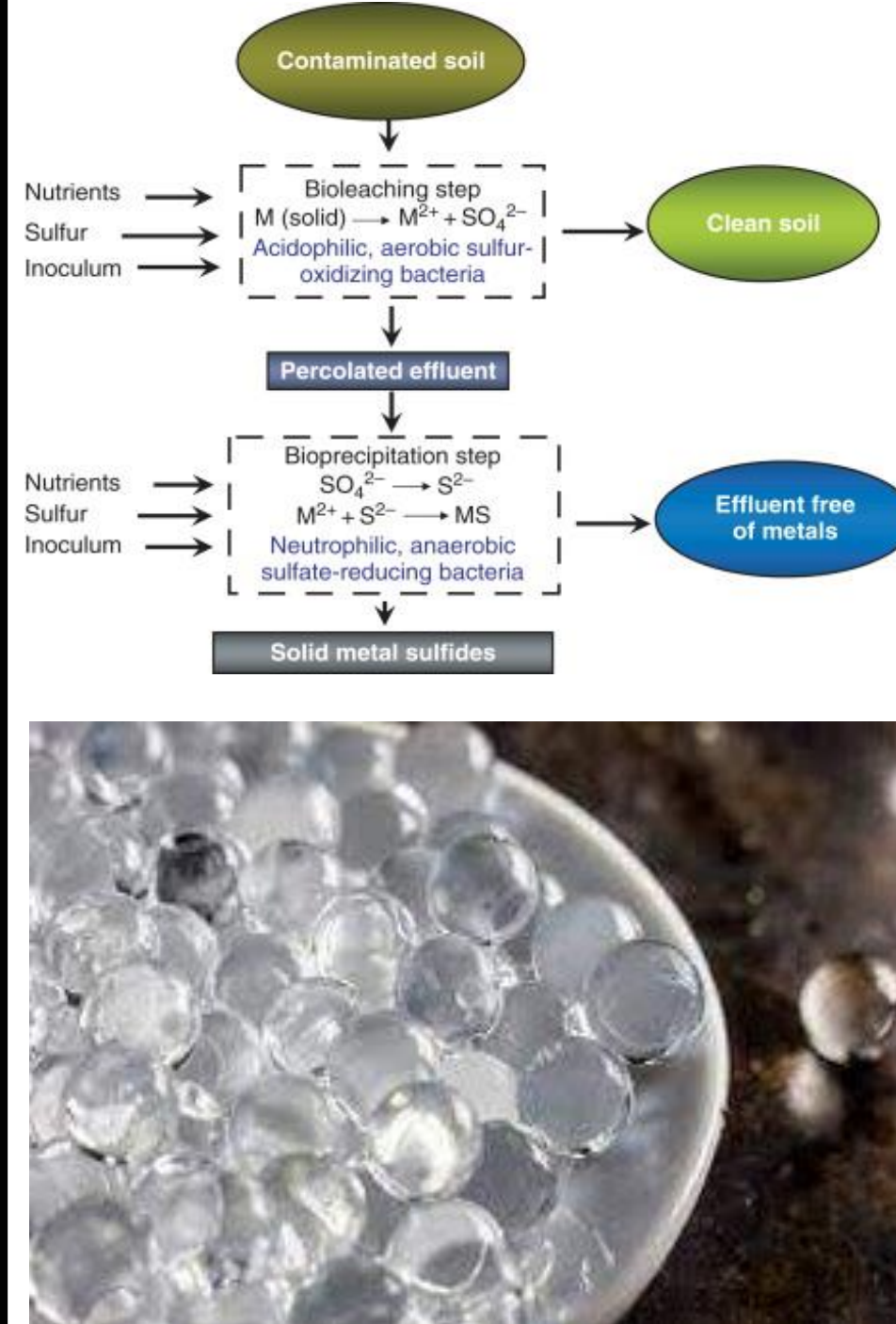
DESIGNS CONSIDERED

Bacterial Intervention

- Bacteria consume sulfur, which reduce AMD generation.
- Rejected due to bacteria's need for additional nutrients.

Super Absorbent Polymer

- Potential to absorb precipitation and prevent water entering Guy Cave.
- Experiments indicate favorable for revegetation.



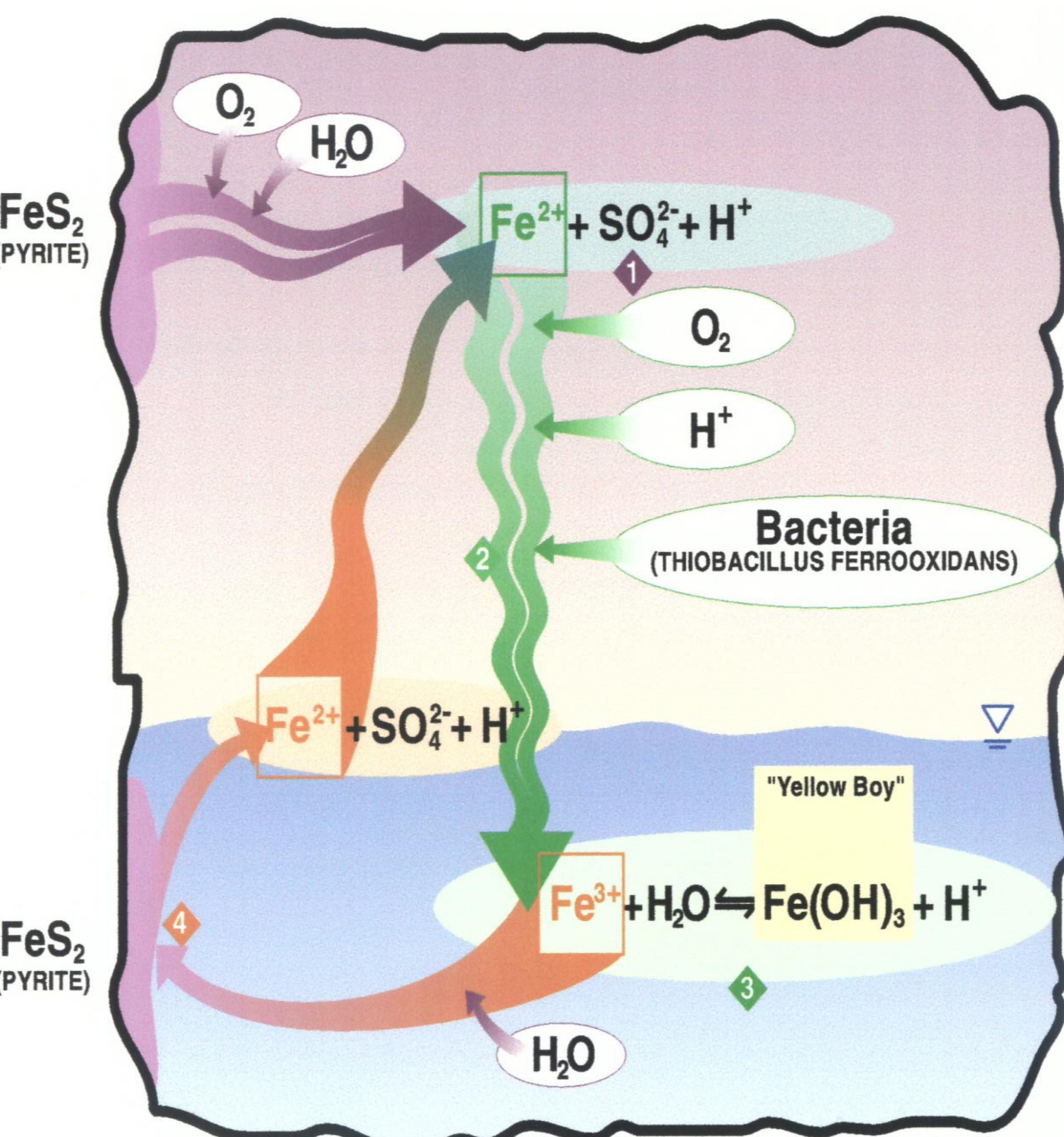
ECONOMICS

Total cost estimated to be \$1.4 million for capping of entire Guy Caves Area.

Item	Amount	Total Price
Bio Ash	3,300 (yd ³)	\$ 66,000
Geotextile	131,000 (ft ²)	\$ 13,100
Geomembrane	44,000 (ft ²)	\$ 44,000
Drainage Layer Aggregate	3,300 (yd ³)	\$ 72,600
Drainage Pipe	1,000 (ft)	\$ 25,000
Common Fill Material	2,500 (yd ³)	\$ 55,000
Topsoil	900 (yd ³)	\$ 45,000
Polymer	10,000 (lbs)	\$ 14,000
Seed/Fertilizer/Mulch	5,000 (yd ²)	\$ 15,000
Grand Total Cost (per acre)		\$ 349,700

ACID MINE DRAINAGE

- AMD is a common pollutant from mining activities.
- AMD is created when sulfur containing minerals contact oxygen and water.
- Commonly caused by pyrite (FeS₂) but can be caused by other metal sulfides



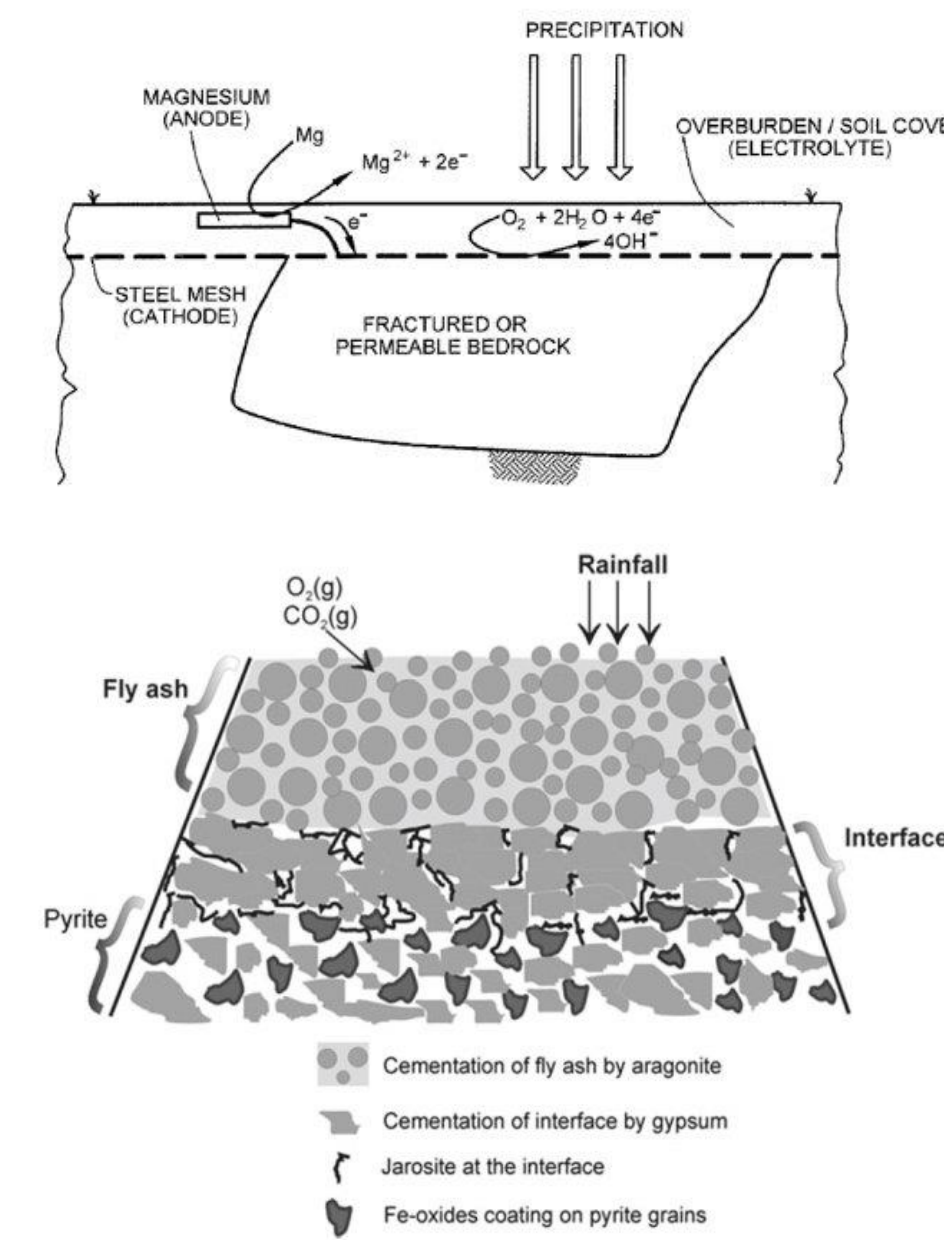
- AMD leaches heavy metals from rocks that it encounters increasing pollution.
- AMD Generation has three reaction mechanisms:
 - Pyrite oxidation from air
 - Bacterial oxidation of Iron
 - Pyrite oxidation of ferric iron

Electrochemical Capping

- Uses cathodic protection to prevent oxidation.
- Rejected due to scale and need for electricity.

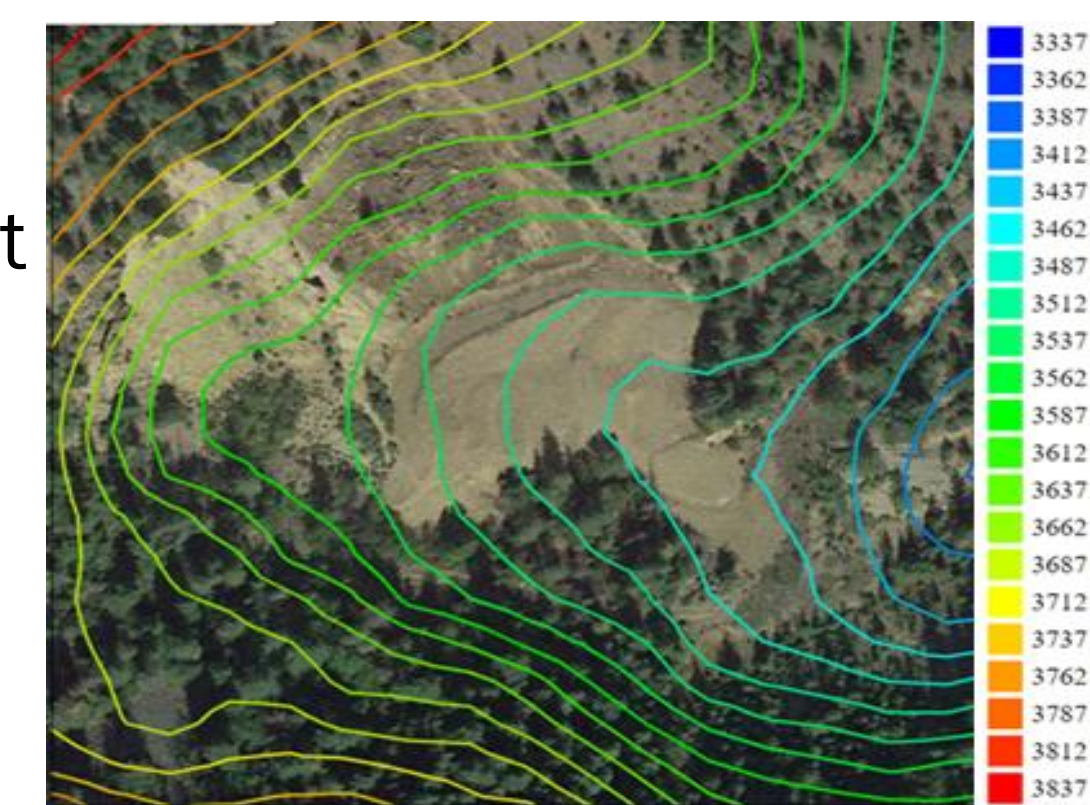
Bio-Ash Capping

- Reacts with water to create impermeable material.
- Increases pH of permeate.



SUPPORTING INFRASTRUCTURE

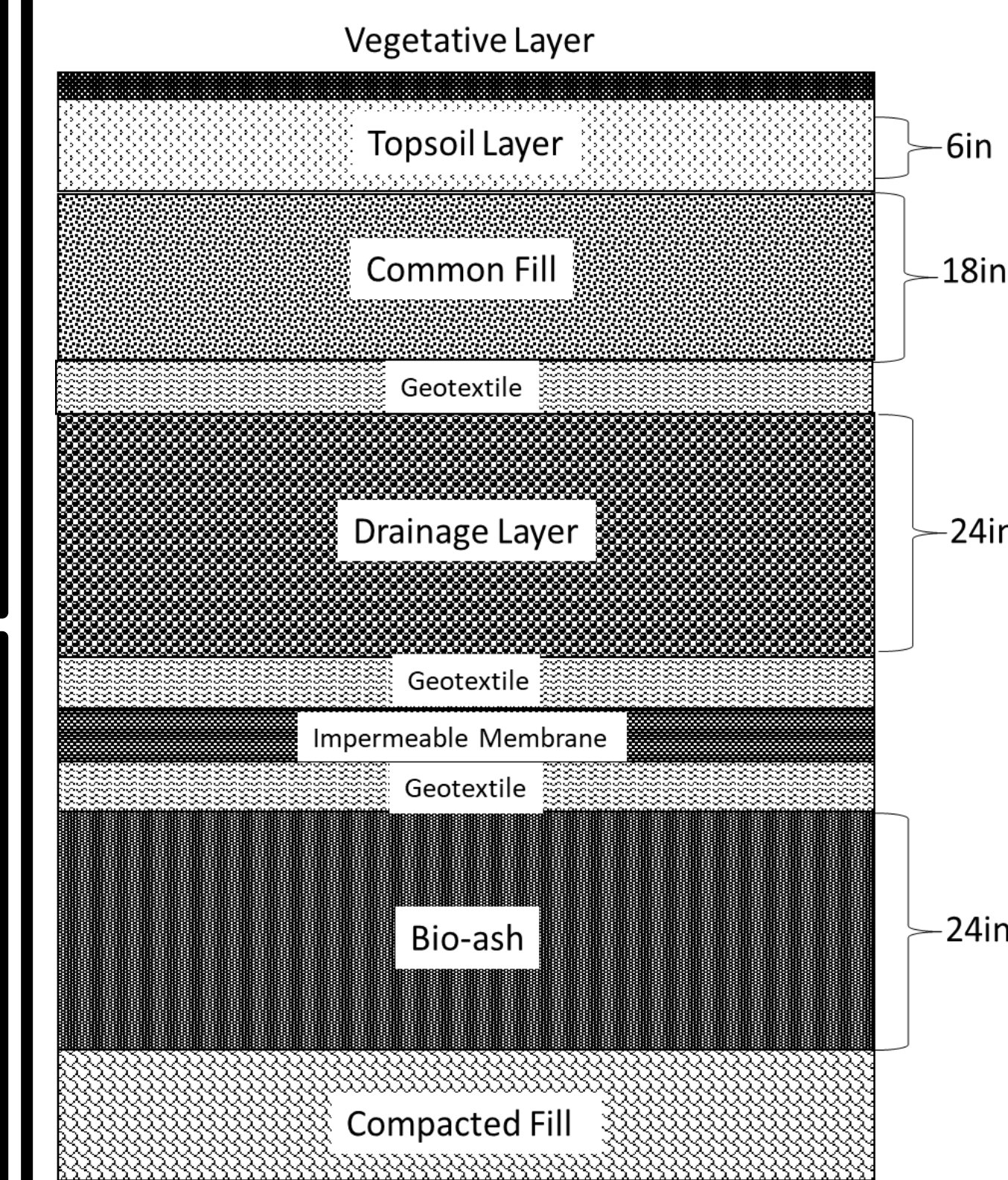
Implementation of the cap requires reworking the slope and improvement of roads to increase access of the Guy Cave area.



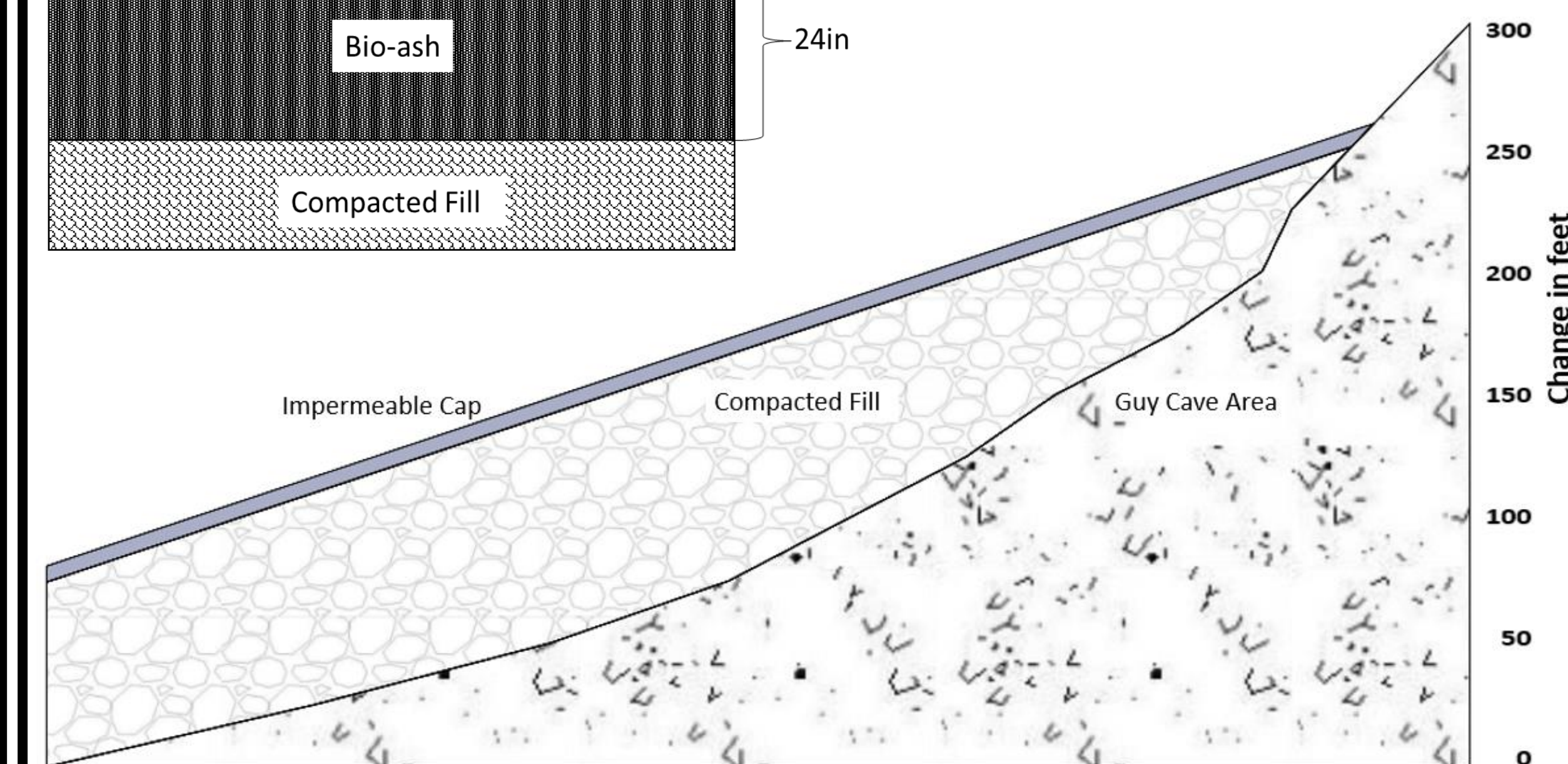
- Cost to level the area is estimated to be \$255,000.
- Cost for road improvement is estimated to be \$95,675.

SOLUTION

The team's proposed solution is a simple layered cap that includes a bio-ash layer and 0.5 wt% polymer in the topsoil.



- A super absorbent polymer layer holds precipitation for the vegetation.
- A bio-ash layer acts as an impermeable reactive layer.
- Other layers are typical of a common mine cap.



ACKNOWLEDGEMENTS

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