2022 Footprint Engineering Inc.

FeTremie RSS QA and CAD Details

Key Footprint Engineering Contacts:

Martin Halliwell - President

Email: martinh@footprintengineering.ca (c): (519)-240-6334

Robert Topham - Vice President of Engineering robertt@footprintengineering.ca (c):

(902)-629-5830

Sarah Taylor - Vice President of Administration saraht@footprintengineering.ca (c):

(905)-483-6497

Section 1.0: FeTremie™ (M.H. Rating: 8/10 - Very Good Revenue Potential)

A system for forming a permeable reactive barrier includes a source conduit for providing a substantially dry barrier-forming material at an initial flow velocity, at a markedly lower cost in hard rock and clay soils.

A delivery conduit arrangement is in fluid communication with the source conduit and includes a first delivery conduit and a second delivery conduit. The first and second delivery conduits each have an outlet end for being positioned proximate a bottom of respective spaced-apart boreholes in the ground. The first and second delivery conduits each have one or more openings defined in respective sidewalls thereof proximate the outlet ends thereof, for venting air that is entrained in the flow of the material.

A total cross-sectional area of a flow path increases between the source conduit and the outlet ends of the first and second delivery conduits. During operation a final flow velocity of the barrier-forming material is at least about 30% less than the initial flow velocity.

Section 1.1: FeTremie™ RSS QA

This invention relates generally to methods and systems for in situ construction of a subsurface containment region for containing hazardous waste or contaminated soil buried under in the ground, and more particularly to a method and system for forming an underground permeable reactive barrier.

1 - DIGGING SERIES OF BOREHOLES TO INTRODUCE THE BARRIER FORMING MATERIAL

Drill a plurality of spaced apart boreholes to initiate the creation of a continuous barrier system.

The diameter of these boreholes would be around 6 inches and are dug out such that an array of such boreholes is created.

The center-to-center distance between the boreholes would be 45cm and they typically would have a depth of 5 to 15m

2 - SETUP FOR OUTLET DELIVERY CONDUIT

Connect both the outlet delivery nozzles with the source material. Both of the outlet delivery conduits will have a wall thickness of 0.6m. To ensure proper flow the two outlet delivery conduits have openings defined in their sidewalls to vent the air that is entrained in the flow which also increases the cross-sectional area of the flow path through which the barrier forming material is flowing.

3 - SETUP FLOW DIVIDER TO REGULATE FLOW VELOCITY

Connect the flow divider such that it is in fluid communication with the source. The flow divider has an inlet through which it receives the barrier forming material and divides the flow into two equal flows which is released through the two outlet delivery conduits.

4 - ATTACH SENSING RINGS TO THE DELIVERY CONDUIT

Connect a sensing ring on both the outlet delivery conduits which are approximately 30cm in length and have a wall thickness of 2.5 to 3 cm and are joined at the outlet end through a weld bead

5 - COMPOSITION OF BARRIER FORMING MATERIAL

The barrier forming material is composed of either silica sand or quartz sand along with iron particles and a thixotropic rheology modifier such as attapulgite or Acti-Gel.

6 - FILLING THE BOREHOLES WITH BARRIER FORMING MATERIAL

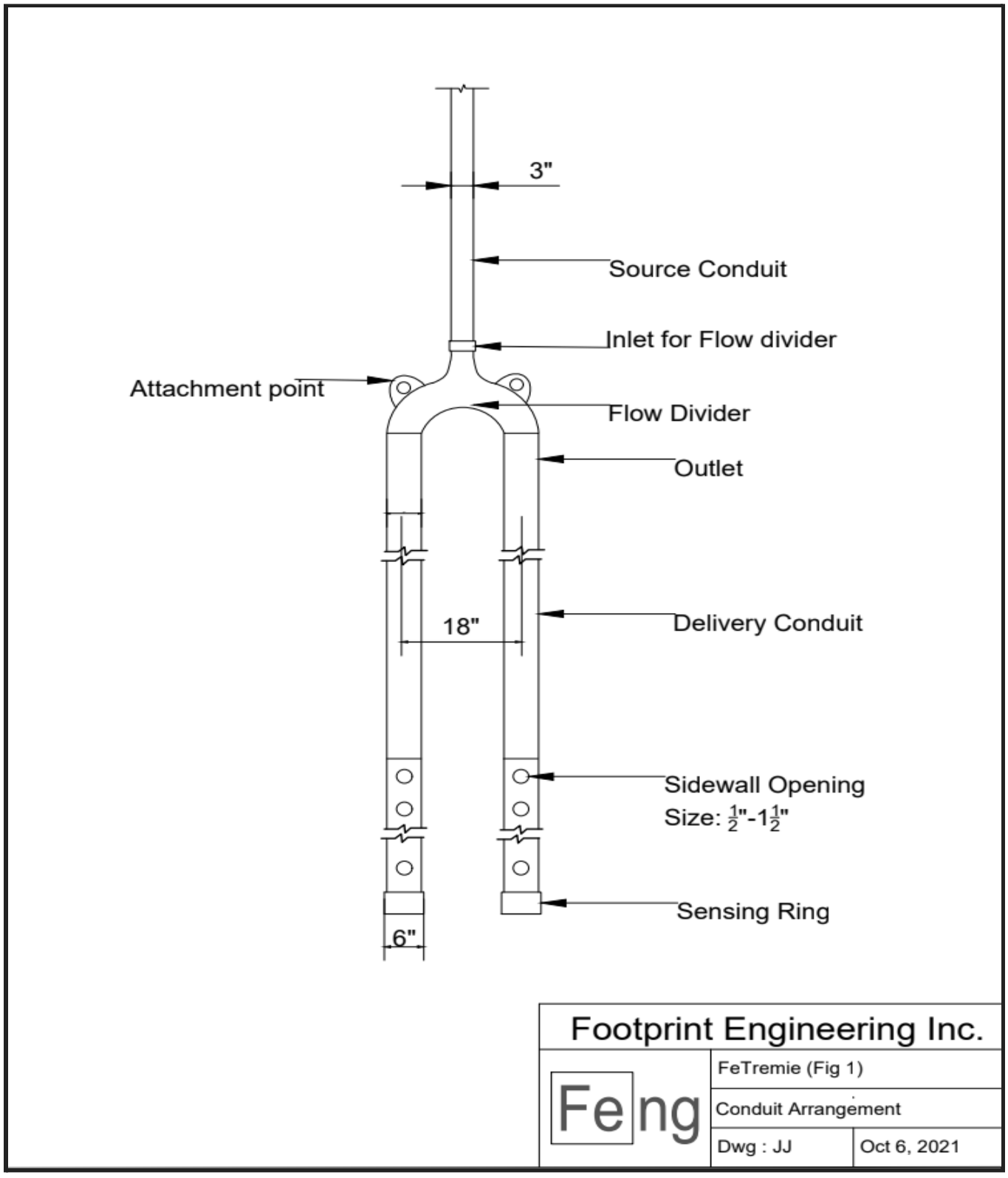
Both the outlet delivery conduits are inserted in two consecutive boreholes and the material is filled in the borehole at an initial flow velocity v_i.

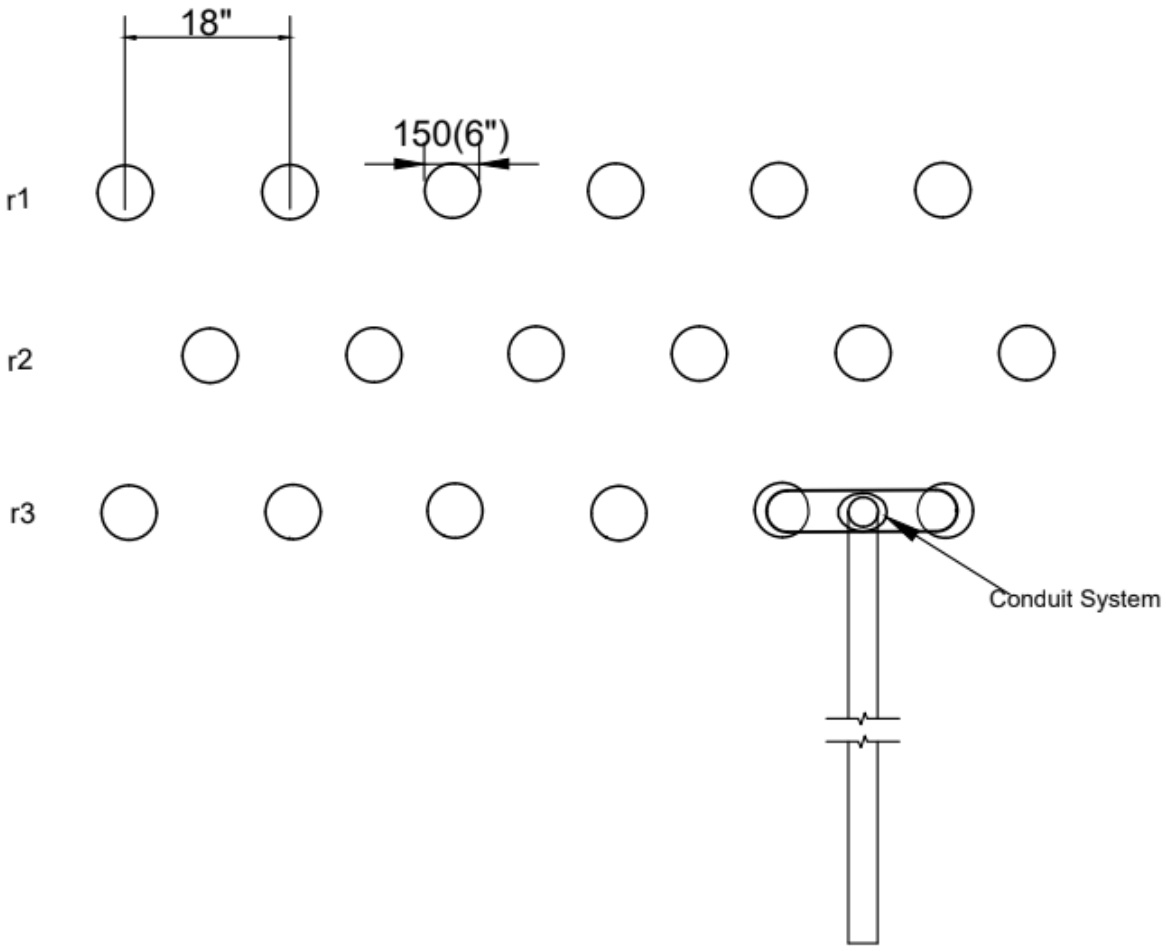
The flow should be maintained as such that the final flow velocity is 30% less than the initial flow velocity as a reduction is required when the outlet delivery conduits are lifted while simultaneously filling the boreholes. Attachments are provided at the outlet end to attach lifting cables for an easy vertical lift through the usage of a crane.

Hence, the two boreholes are filled at the same time, which reduces the total time required to construct the permeable reactive barrier.

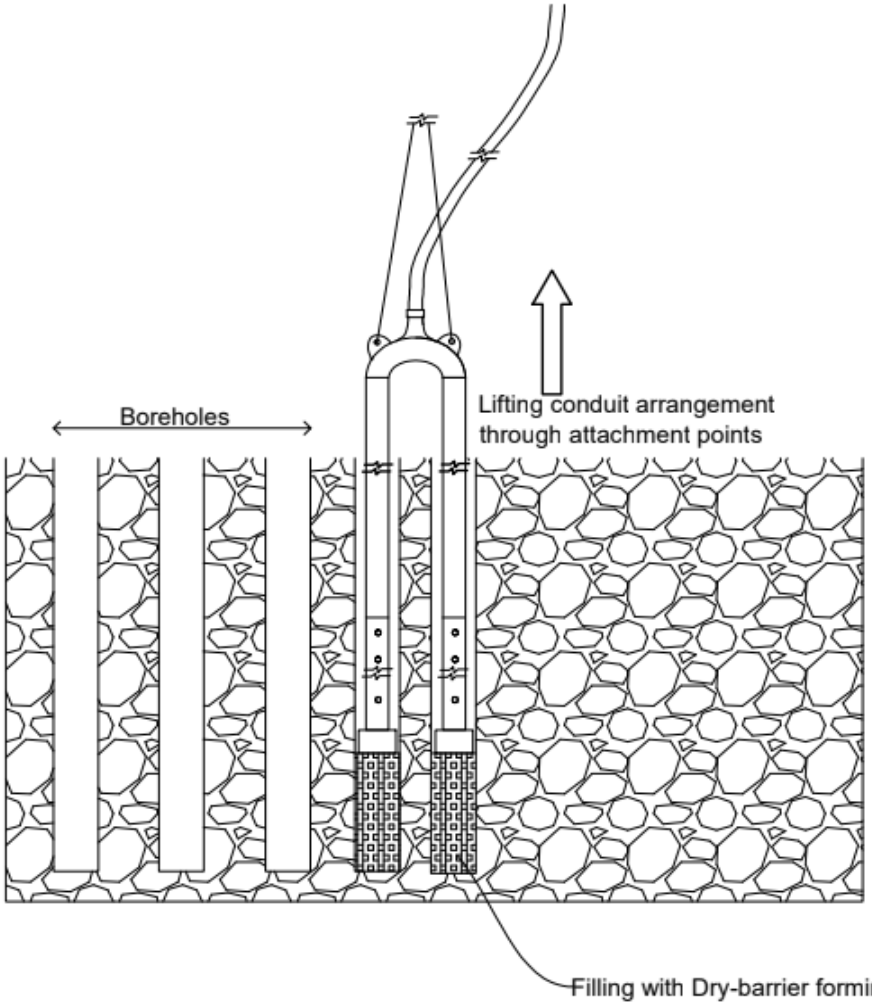
Section 1.2: FeTremie™ CAD Illustrations

Computer-aided illustrations depicting a typical FeTremie™ system can be seen in the following drawings below.

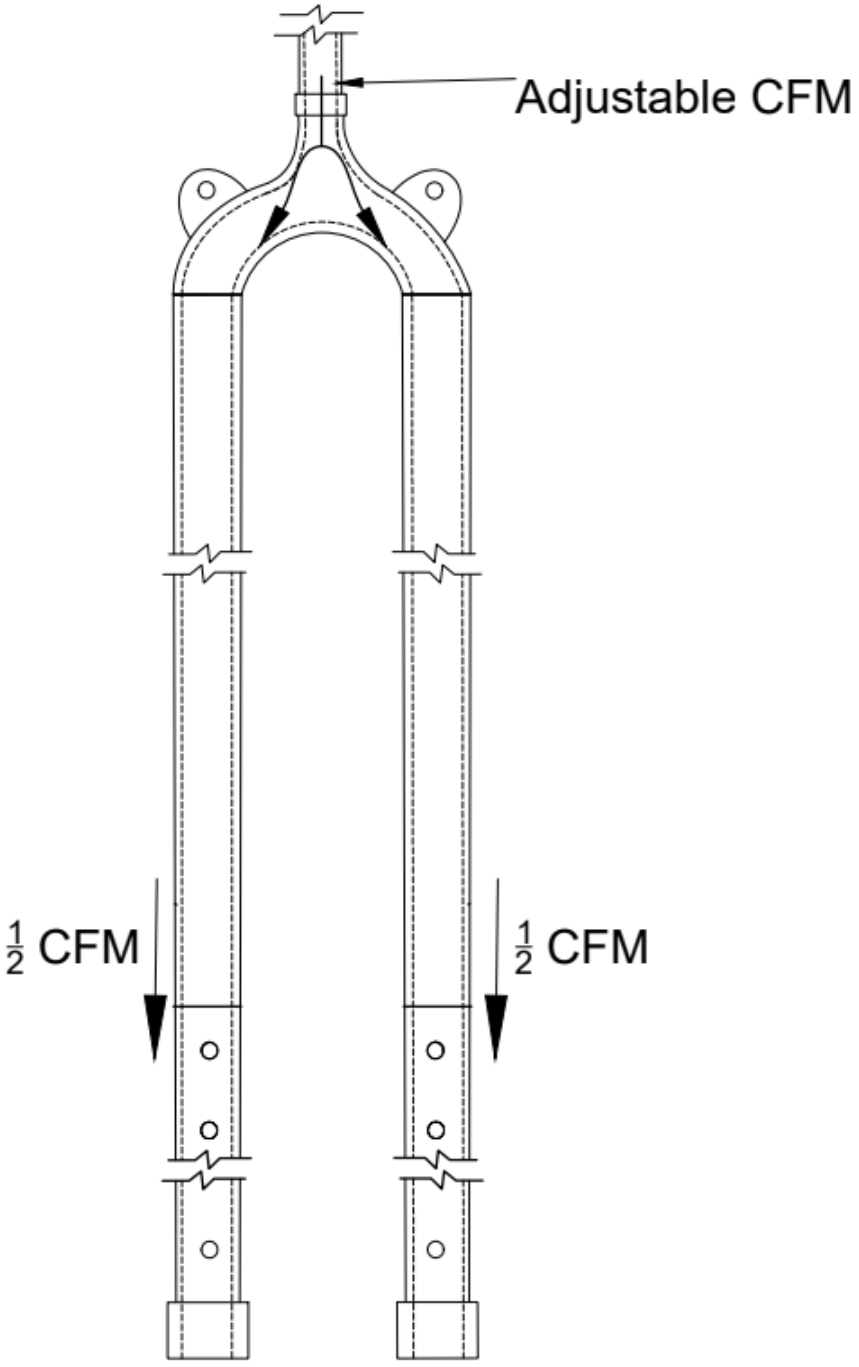




Footprint Engineering Inc.		
Feng	FeTremie (Fig 2)	
	Plan: Tremie Operation	
	Dwg : JJ	Oct 6, 2021



Footprint Engineering Inc.		
Feng	FeTremie (Fig 3)	
	Elevation: Tremie Operation	
	Dwg : JJ	Sep 28, 2021



Footprint Engineering Inc.		
Feng	FeTremie (Fig 3)	
	Flow through Conduit System	
	Dwg : JJ	Oct 6, 2021