



Application Note #9

Heavy Oil Recovery WITHOUT Water Treatment

Do you have a "Heavy Oil" (like #6 fuel oil) site where the depth to product is too deep for dig and haul, pumping groundwater is not an option, and you would really like to see closure of this site in your lifetime? Then we suggest you take a good read on Xitech's approach to solving this very tough problem.

Xitech has learned over many years of remediating Heavy Oil sites that the greatest obstacle we have had to face was obtaining a decent recovery rate from extraction wells. Xitech has developed several innovative ideas and technologies which have provided a good cost/benefit to our customers.

You will find that what we are about to suggest to you will not create conflict with your clients, regulators or other consultants. Remember, whatever approach you do choose you will be judged harshly on how much Free Product is retrieved every day, month and year. So, recovery rate is what we suggest you collect and compare as your indicator of progress, NOT product thickness.

Xitech has six aspects to its remediation of Heavy Oil.

- I. Xitech's Well Design For Recovering Heavy Oil**
- II. Xitech's Method For Developing Heavy Oil Wells WITHOUT Disturbing The Product Plume**
- III. Xitech's Method For Enhanced Recovery Of Heavy Oil Using Low Vacuum**
- IV. Xitech's Technology For Enhanced Recovery Of Heavy Oil Using Localized Heat**

I. Xitech's Well Design for Recovering Heavy Oil

Change Well Annulus Material

Changing the well annulus material to medium size pea gravel would provide better conductivity between the formation and the well casing, thus increasing the LNAPL migration rate into the well. This can be accomplished because the removal rate of LNAPL out of a well is much lower than water removal, therefore, the migration of suspended solids into the well are greatly reduced or eliminated. Also, the sands currently being used as well annulus fill material have lower conductivity than other materials for LNAPL. This design resembles a French drain approach except we are using a vertical conduit instead of a horizontal trench.

Reduce the Well Boring Diameter

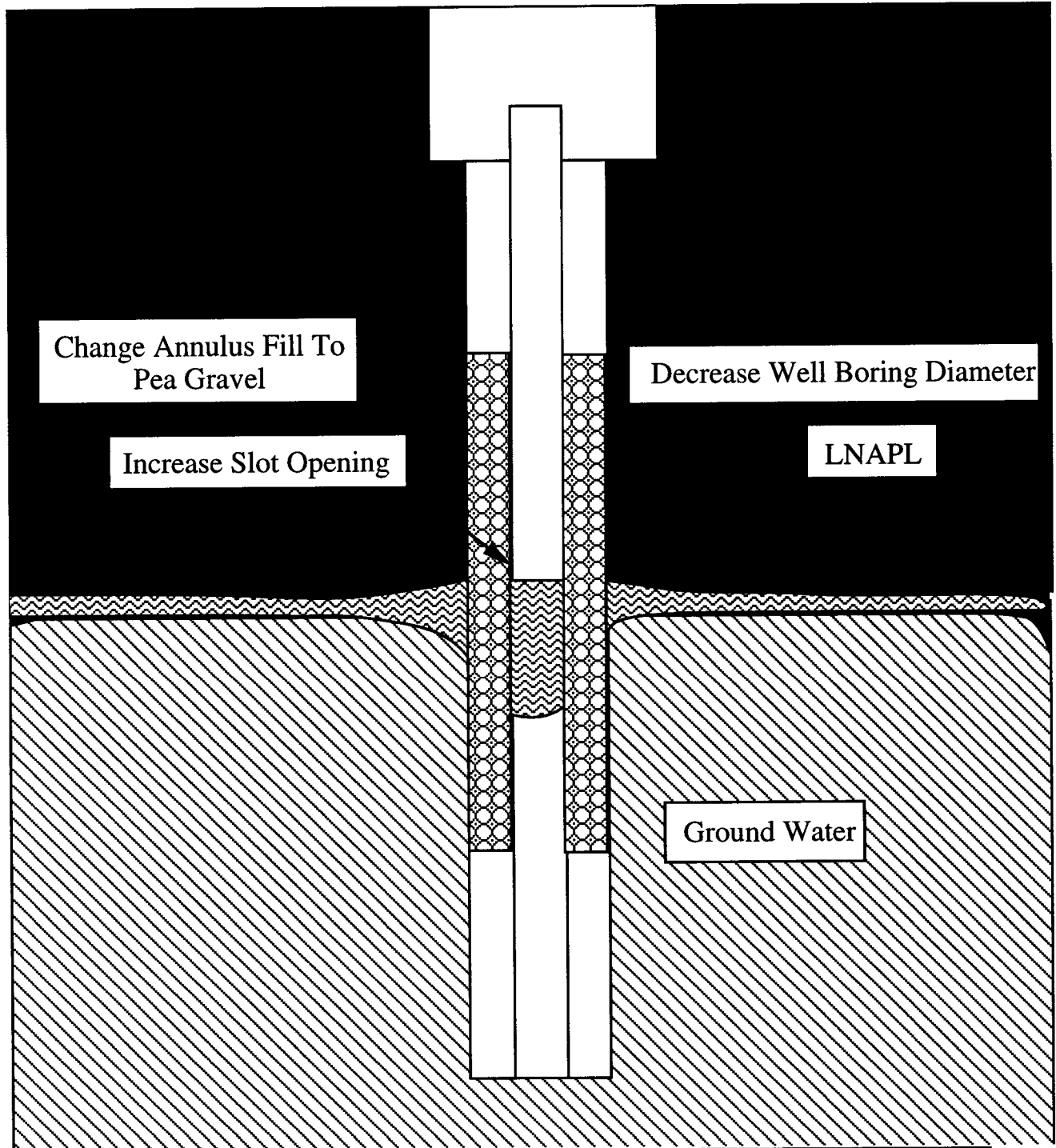
Reducing the well boring diameter will make it easier to clear away the mudded up (smeared) well boring and lower drilling costs.

Use Continuous Wire Wrap Stainless Steel Well Casing for the LNAPL Collection Zone

The typical slotted well casing material used for most Free Product recovery is Schedule 40 PVC pipe with 10 or 20 slot size. The wall thickness of the casing (1/4" wide) and the small slot height create a high surface tension barrier for the Free Product to migrate through. A better choice would be continuous wire wrap stainless steel with 50 thousandths slot width to lower the surface tension barrier.

See page 3 for more details.

Xitech's Heavy Oil Well Design



II. Xitech's Method for Developing Heavy Oil Wells WITHOUT Disturbing the Product Plume

Xitech has observed a wide variety of approaches for preparing an extraction well for use ranging from do absolutely nothing to very aggressive jetting of wells. We have observed that most consultants leave well development to the drillers and pay very little attention to how they perform this task. When Free Product does not show up in the newly constructed extraction well, the usual plan of ACTION by the consultant is to wait for the LNAPL to show up. I have seen consultants wait several months before they think they need to change their plan of ACTION.

Drillers using the vacuum truck approach for well development have not really done any development of the well. Vacuuming out a well does not clear out mudded up well borings or silted up well annuluses.

Drillers using the jetting method have created multi-month delays in having LNAPL show up in newly constructed extraction wells due to injecting large quantities of water into your new extraction well which only pushes the LNAPL plume away from the well.

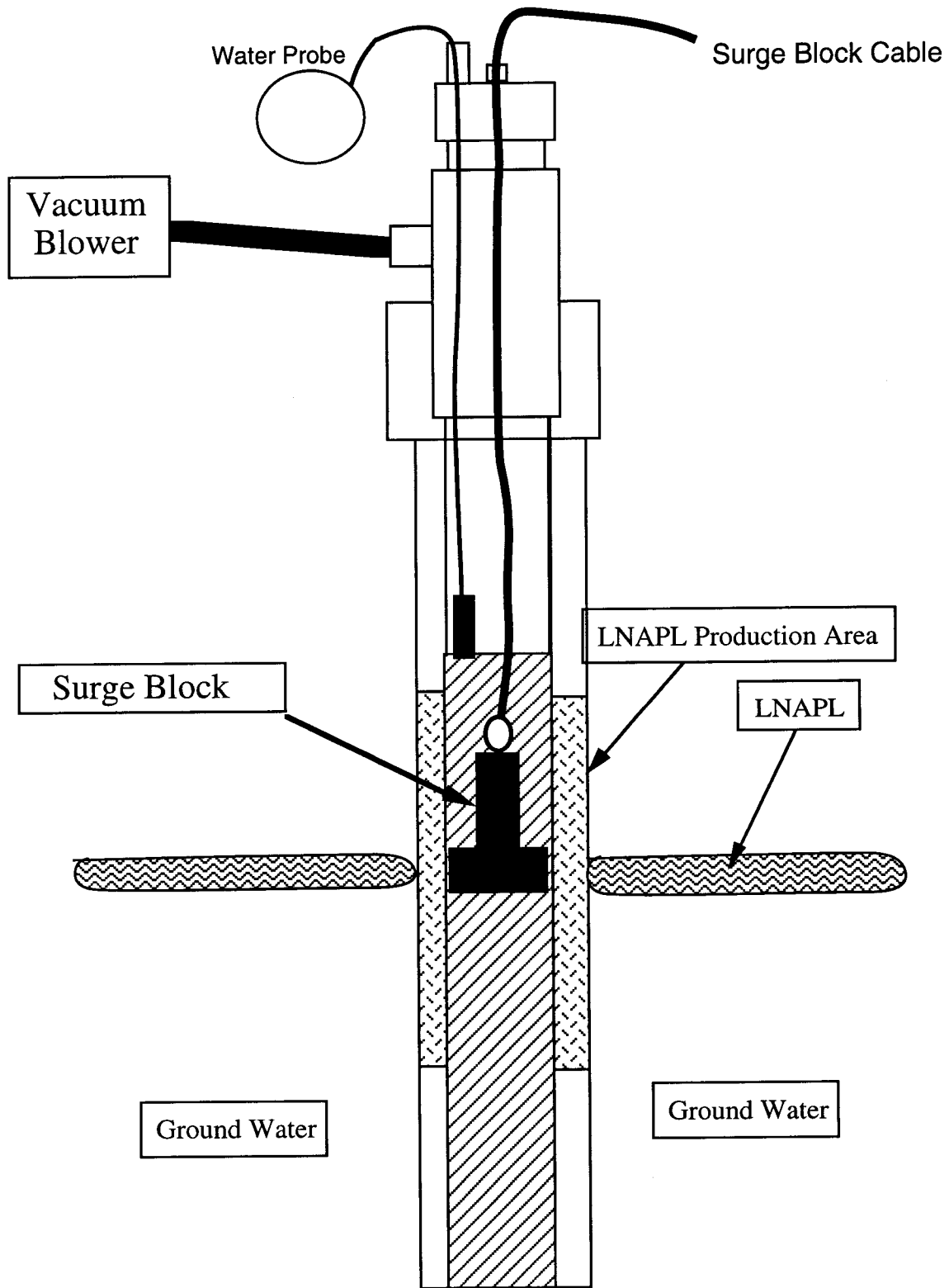
Real thought needs to go into how an extraction well would best be prepared for Heavy Oil recovery. Xitech has found that the most effective method and least disturbing to the LNAPL plume is using the age old surge block and rod approach. To clear out the mudded up well boring area above the static water level in the extraction well will need special consideration. Here is one good way to get the screened area above the static water level developed.

Vacuum Assisted Well Development Of LNAPL

This method of well development is accomplished by applying a strong vacuum to the recovery well to lift the static water level up several feet in the well. While the vacuum holds the water level at an elevated height in the well, place a surge block in the area just above the static water level to loosen the smeared well boring and remove the silts from the well annulus. The amount of time to develop a well can vary from 10 minutes to 30 minutes depending on the soil type. This method will require a vacuum source (e.g. 50cfm @ 80 inches of water) and a special well cap for the surge block cable.

See page 5 for more details

Vacuum Assisted Well Development



III. Xitech's Method for Enhanced Recovery of Heavy Oil Using Low Vacuum

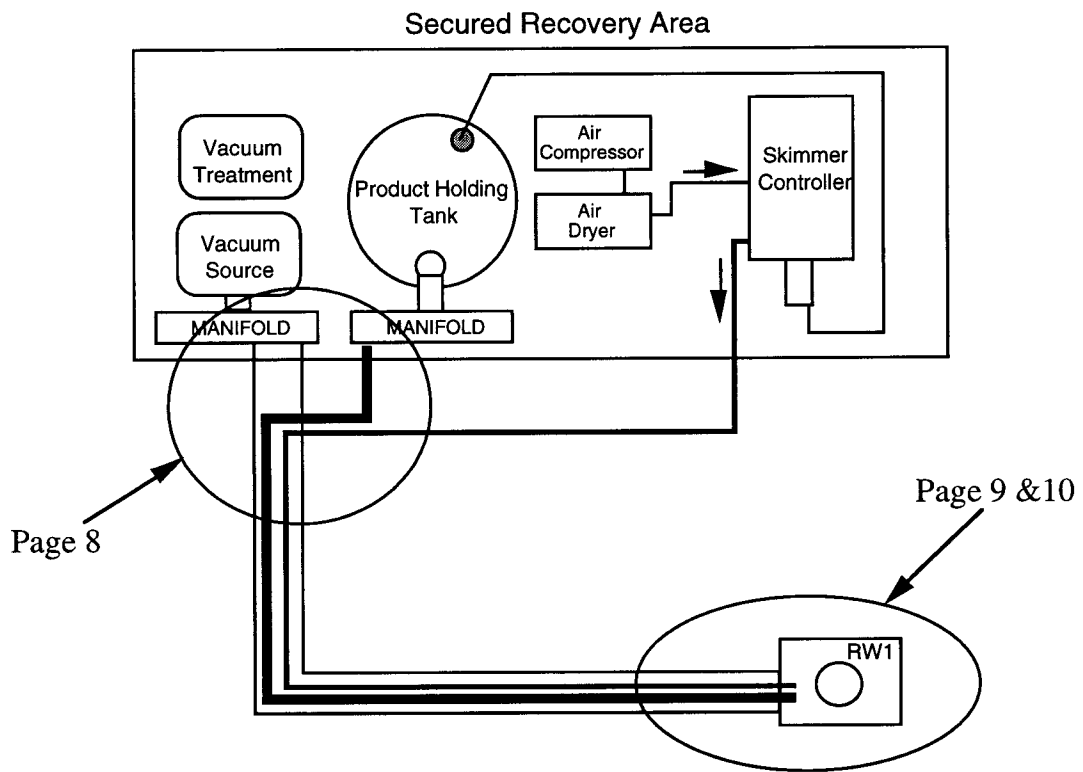
Here is a way to increase the rate at which LNAPL can migrate to your extraction well.

Xitech has observed that applying a LOW (15-20 inches of water) vacuum can increase the migration rate of LNAPL to an extraction well. Vacuum above 20 inches of water vacuum at the well usually stops all migration of LNAPL to the well due to water mounding in the well. Maintaining a constant LOW vacuum at the extraction well is very important. Special diaphragm valves must be used, NOT ball valves. If you can double the migration rate to your extraction well, you have just cut your remediation time on the site in half. See Xitech's Application Note 2 and Application Note 7 for more details on the effects of low vacuum on LNAPL recovery.

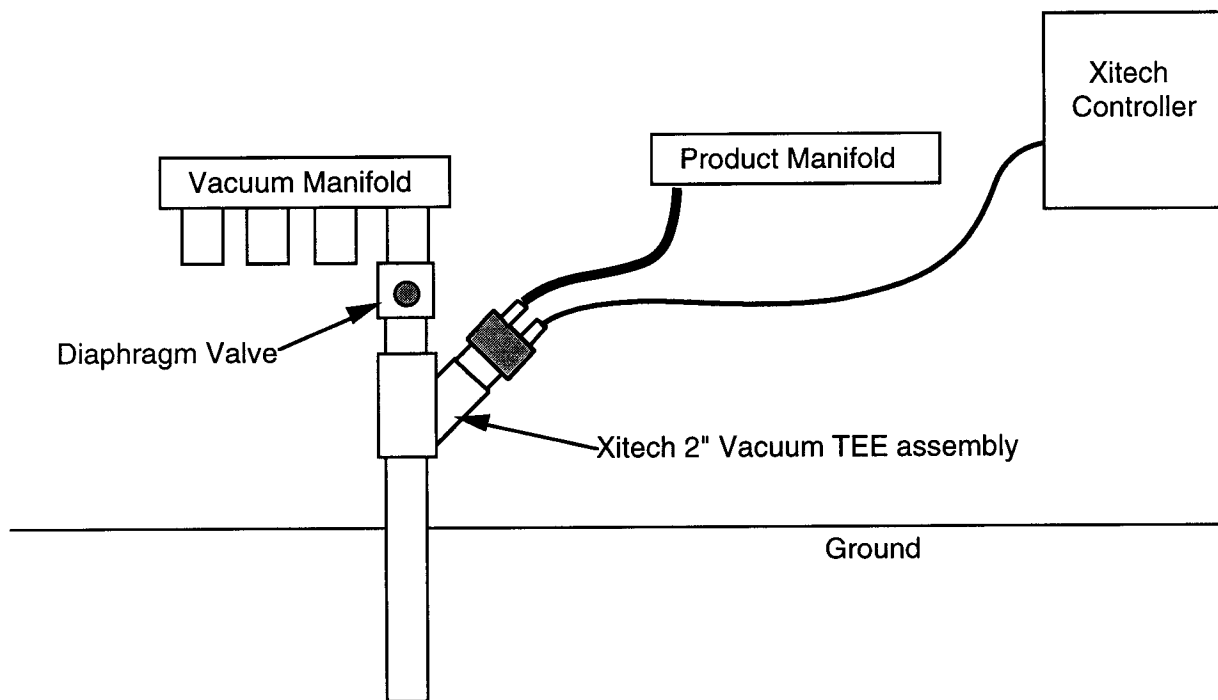
Xitech has also created a clever way to save construction cost on a LOW vacuum and skimming system. First we suggest you run a 2" PVC pipe conduit from the recovery compound out to each well. Next we suggest you place the skimmer air supply and product discharge lines inside each of these 2" vacuum lines. Finally, Xitech has custom well head assemblies that include a Y-Tee for breaking out the air supply lines at the well vault.

See pages 7,8,9, and 10 for more details.

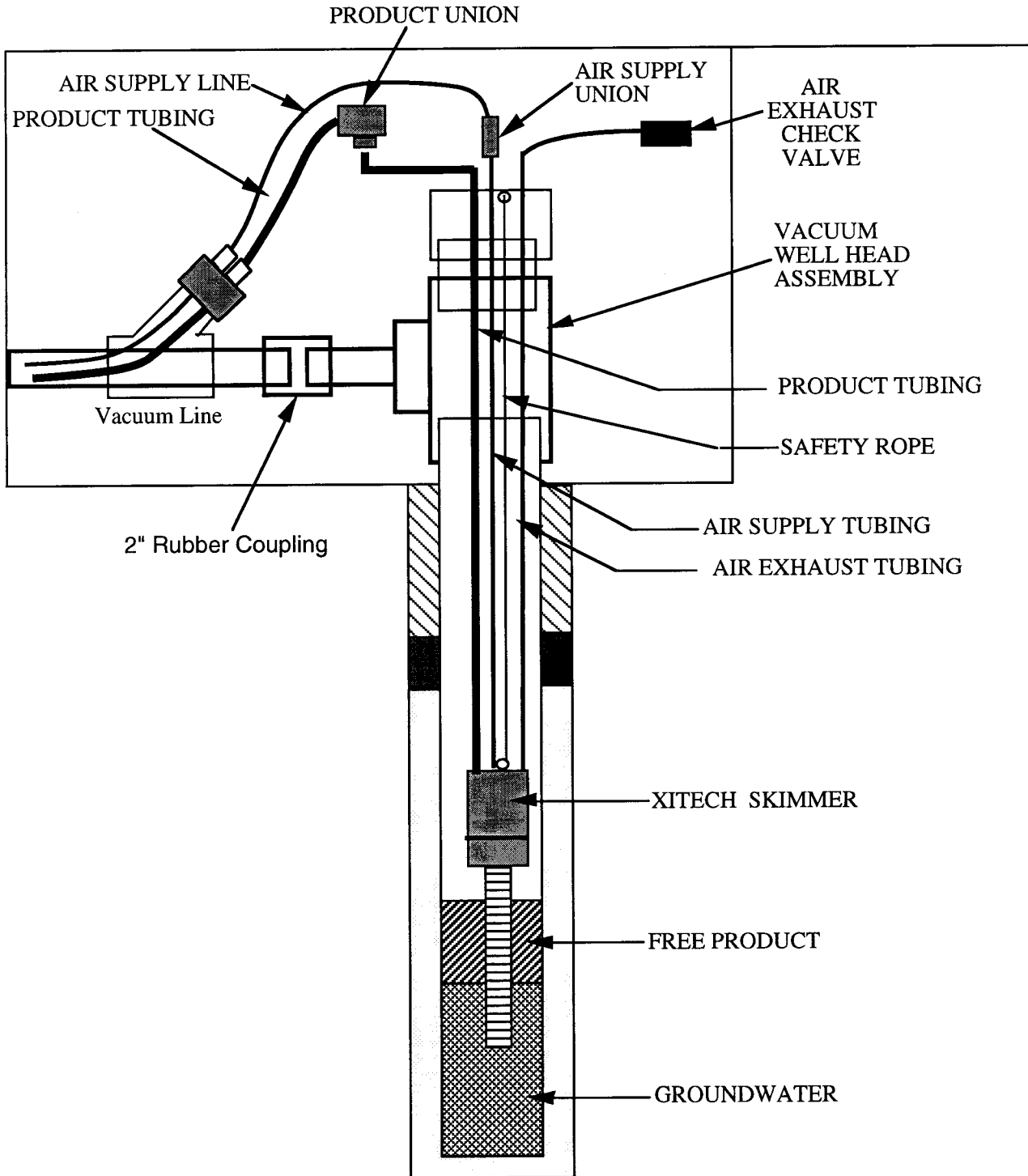
Multi-Well LNAPL Skimming With Low Vacuum



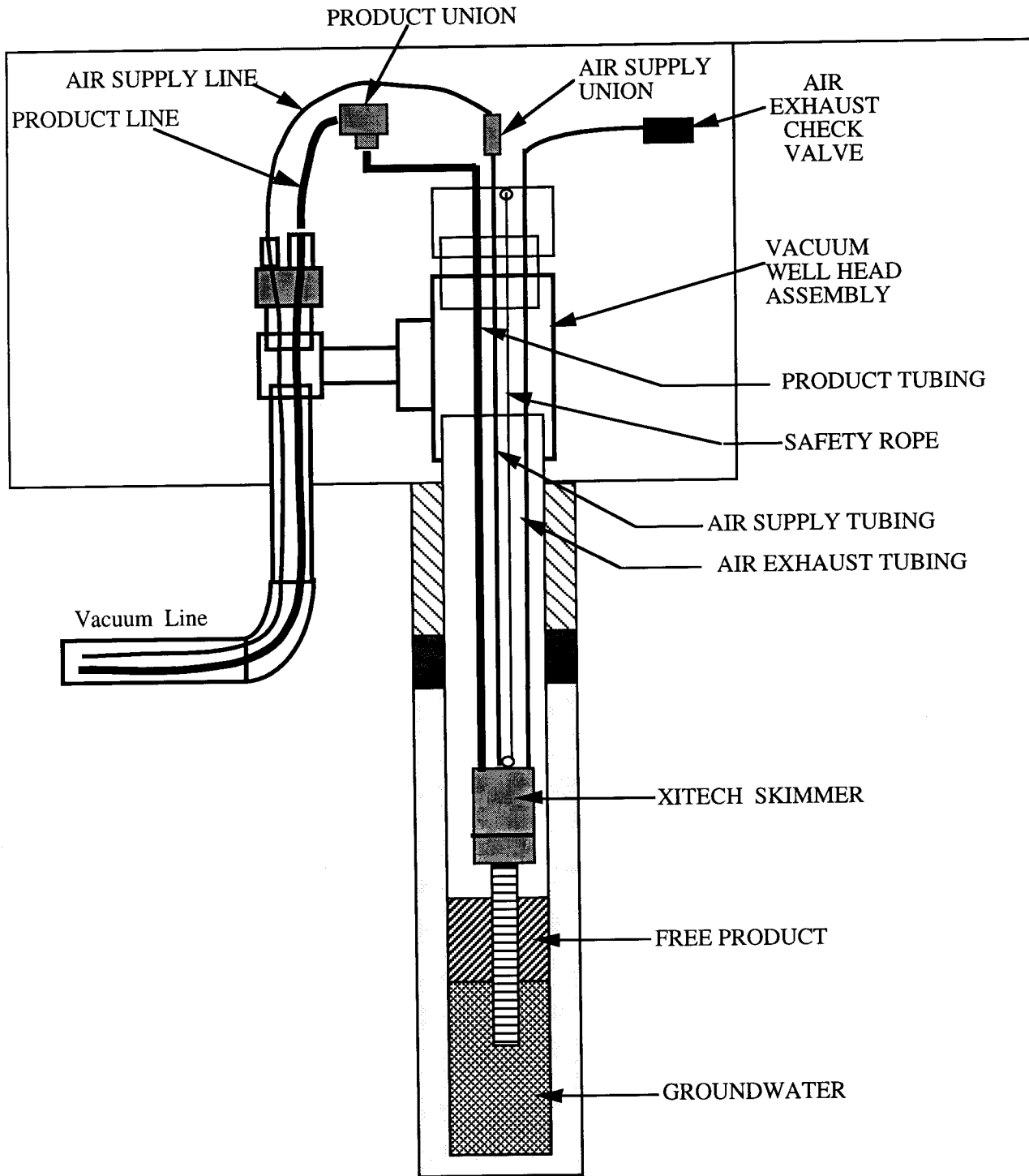
Detail Well Design



Detail Well Design Shallow Trench



Detail Well Design Deep Trench



Xitech's Technology for Enhanced Recovery of Heavy Oil Using Localized Heat

Xitech has developed an optional compact heat source which lowers the viscosity of the Heavy Oil entering the extraction well. Maintaining a lower viscosity increases the rate of recovery and allows for recovery in the winter time. Xitech has attached a small 75 watt finger heater to its Heavy Oil Skimmer (ADJ1010H) so the heater is always in water. The heater maintains a 80 degree water temperature in the well casing and boring. The warmer water lowers the viscosity of the Heavy Oil entering the boring. We are not trying to super heat (i.e. steam injection) the LNAPL. Over heating the LNAPL can cause real problems by increasing the dissolved phase.

See page 12 for more detail.

Skimming System with Heated Product

