Rajiv Gandhi Institute of Petroleum Technology

BTP PRESENTATION

FLOW ASSURANCE USING OLGA SOFTWARE

PETROLEUM ENGINEERING & GEO-SCI DEPARTMENT

SUBMITTED BY

RITESH RAGHUVANSHI - 20PE3035

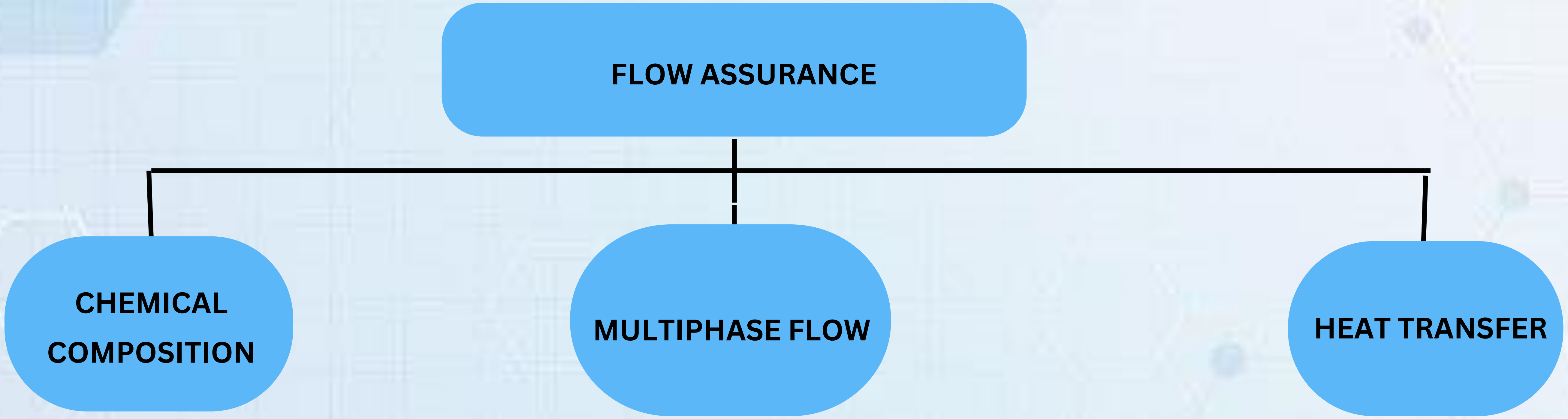
MANOJ KUMAR L M - 20PE3018

FACULTY MENTOR

DR. SHAILESH KUMAR

INTRODUCTION

- Flow Assurance is a process that is used to ensure that hydrocarbon fluids are transmitted economically from the reservoir to the end user over the life of a project in any environment



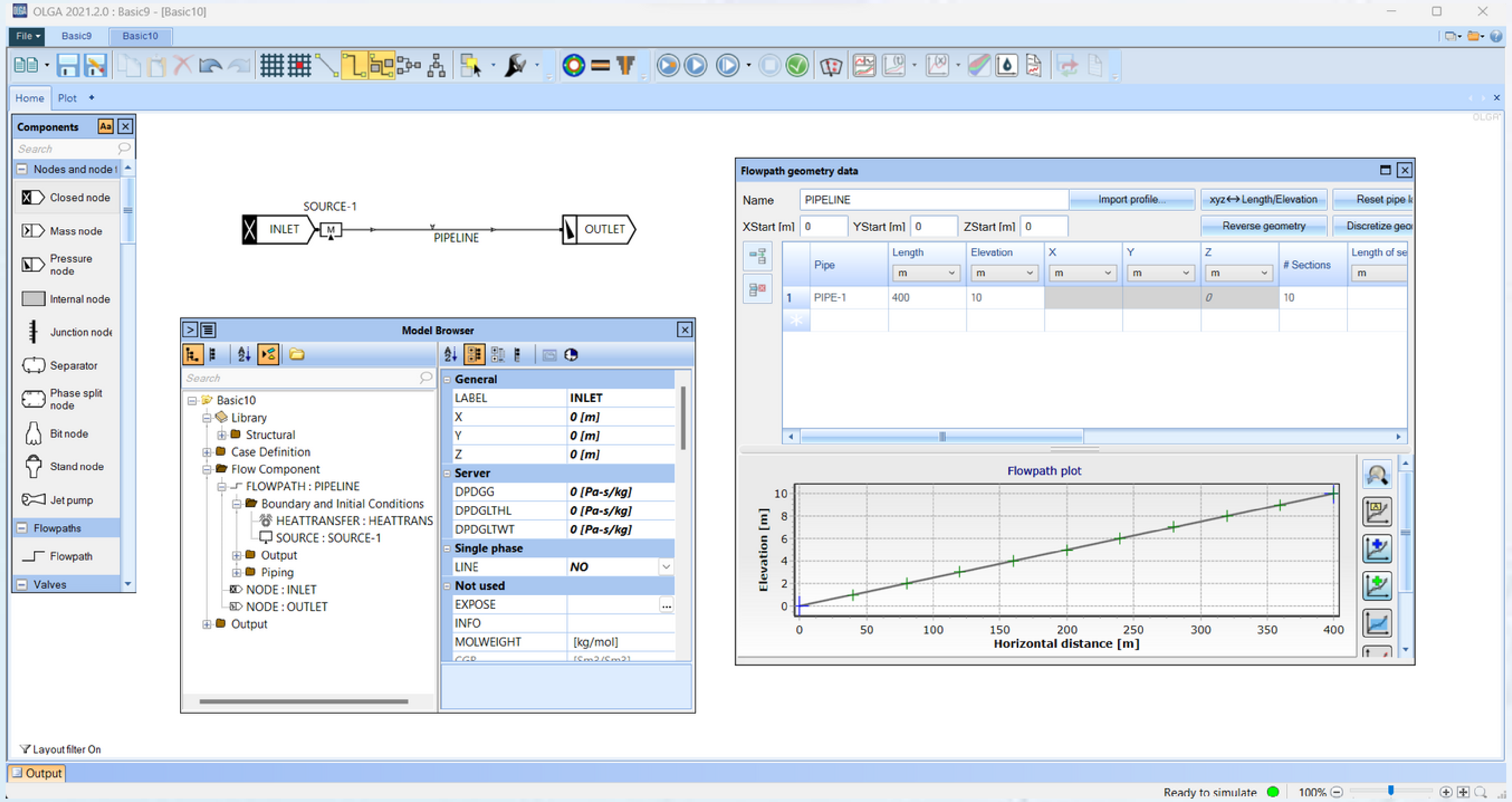
CHEMICAL COMPOSITION
- Hydrates
- Wax
- Asphaltenes
- inorganic scale
- Naphthenates

MULTIPHASE COMPONENTS
- Oil
- Gas
- Water
- Sand

HEAT TRANSFER
- Understanding temperature profile

OLGA SOFTWARE

- OLGA is a modelling tool for the transportation of oil, natural gas and water in the same pipeline, so-called multiphase transportation.
- The name is short for "oil and gas simulator".
- It’s a Transient Dynamic simulator



Main windows displayed on the screen

- Components
- Model Browser
- Flow path Geometry Data
- Diagramatic Representation
- Tools

External Tool Used

- MultiFlash - For generating input fluid files in OLGA

WAX DEPOSITION

- **Wax Appearance Temperature (WAT) or Cloud Point is the temperature at which the first wax crystals form.**

- **The primary component of wax in crude oils is n-paraffins (>C16)**

- **Only N25, N26, N30 & N31 will form Wax**

Standard properties | Extended properties

	Component	Type
45	N25	n-Paraffin
46	N26	n-Paraffin
47	N27	non n-Paraffin
48	N28	non n-Paraffin
49	N29	Normal
50	N30	n-Paraffin
51	N31	n-Paraffin

n - paraffins

non n - paraffin

normal

CRUDE SAMPLES TAKEN

- **SAMPLE A - NORMAL CRUDE**
- **SAMPLE B - WAXY CRUDE**
- **SAMPLE C - ASHPALTENE**

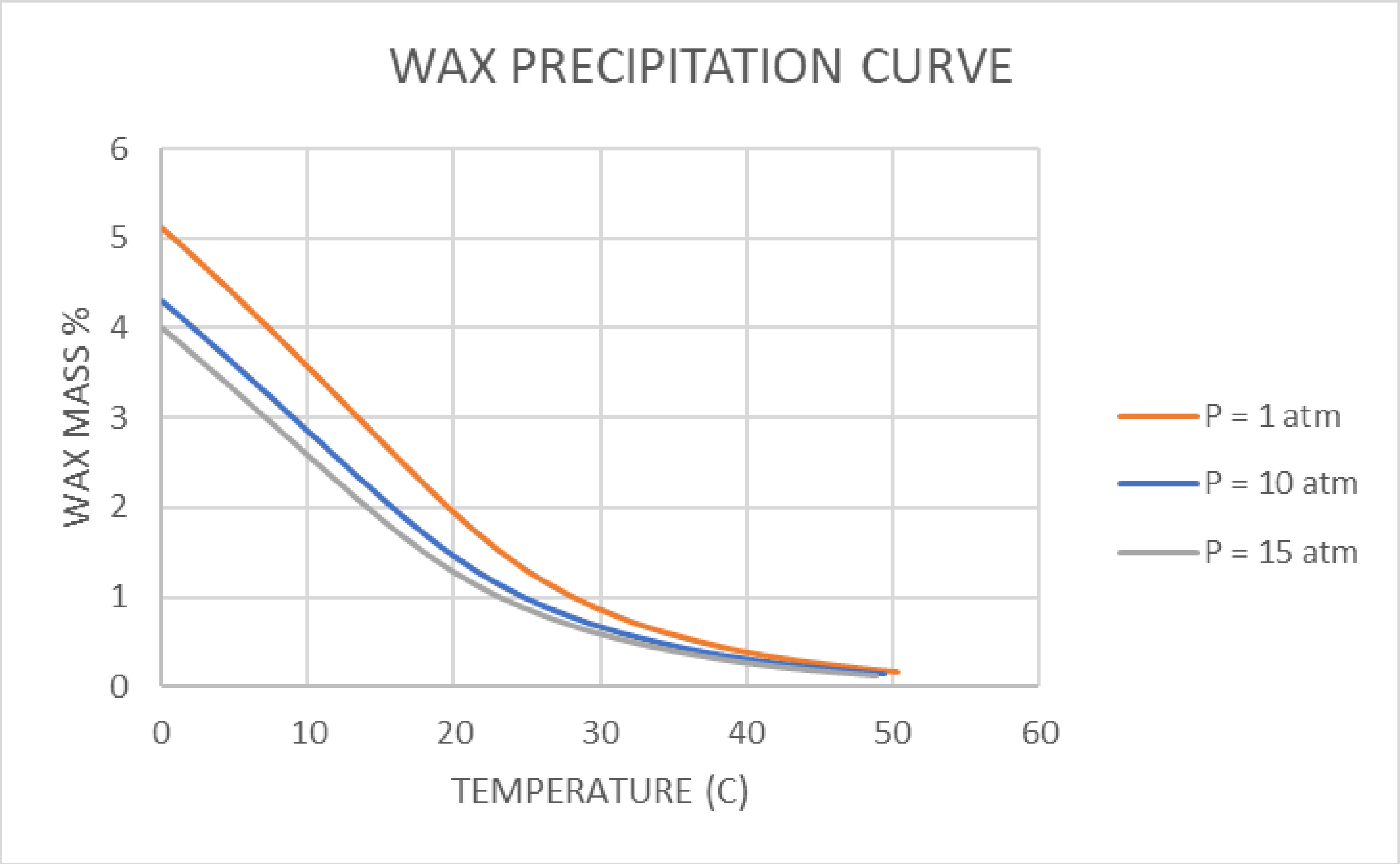
CRUDE SAMPLE - B

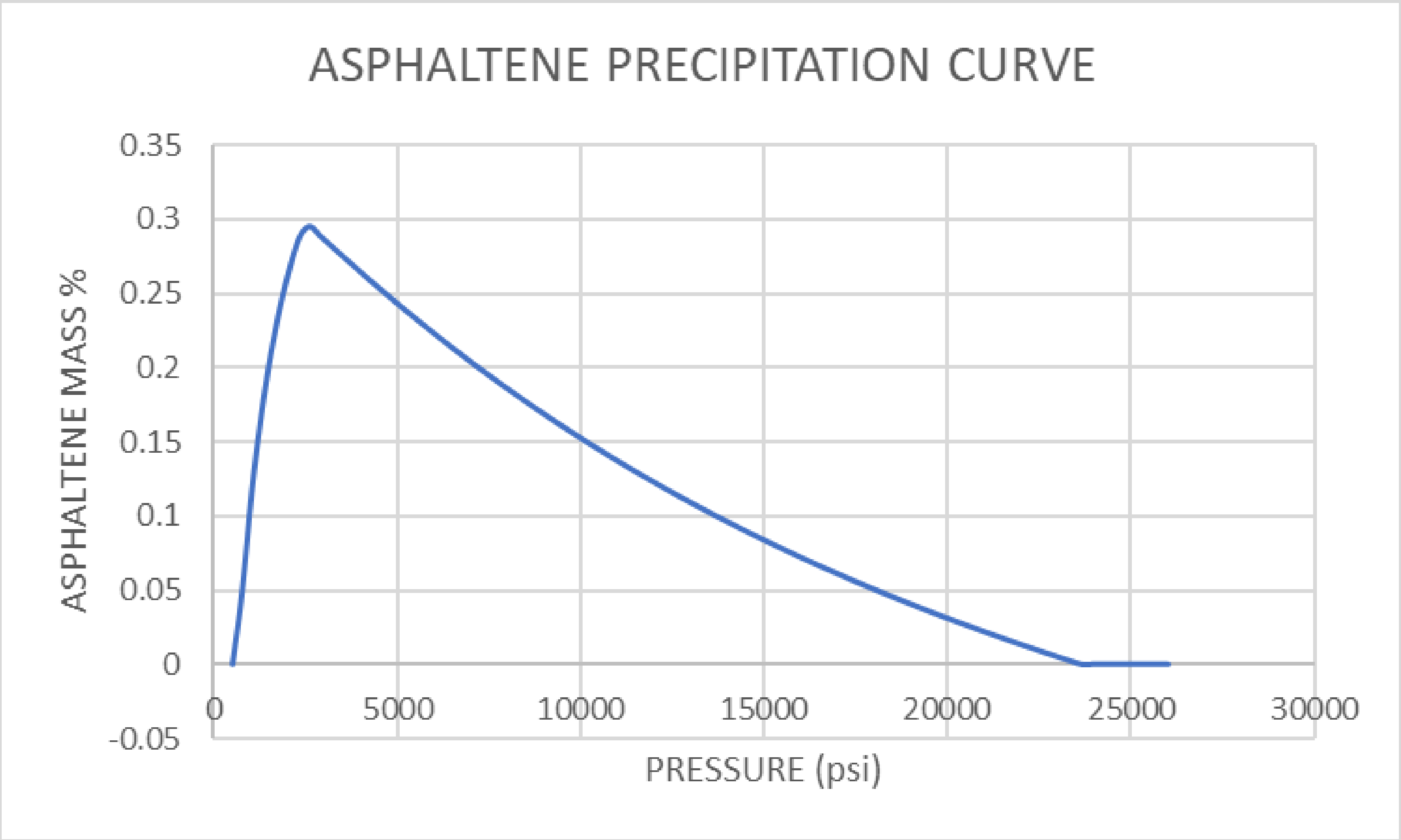
WAT	**57.67 C**
WAX (mol %)	**3 x 10^-3**

Temperature: **57.674 °C** Pressure: **1.000 atm**
Number of Phases: **3** Solution Stability: **Stable**

Phase Compositions

	Component	OVERALL (mol fraction)	GAS (mol fraction)	LIQUID1 (mol fraction)	WAX (mol fraction)
95	N75	7.53524092e-07	0	4.901500656e-07	0.02021124295
96	N76	6.08947727e-07	0	3.582121533e-07	0.0166615013
97	N77	4.98981003e-07	0	2.679835734e-07	0.01387384609
98	N78	4.089413179e-07	0	2.038974279e-07	0.01150655073
99	N79	3.352039281e-07	0	1.645986575e-07	0.009453708429
100	N80+	9.607977285e-07	0	1.579749708e-07	0.02981457656
	Total	**1**	**0.7331665312**	**0.2668026567**	**3.081209572e-05**





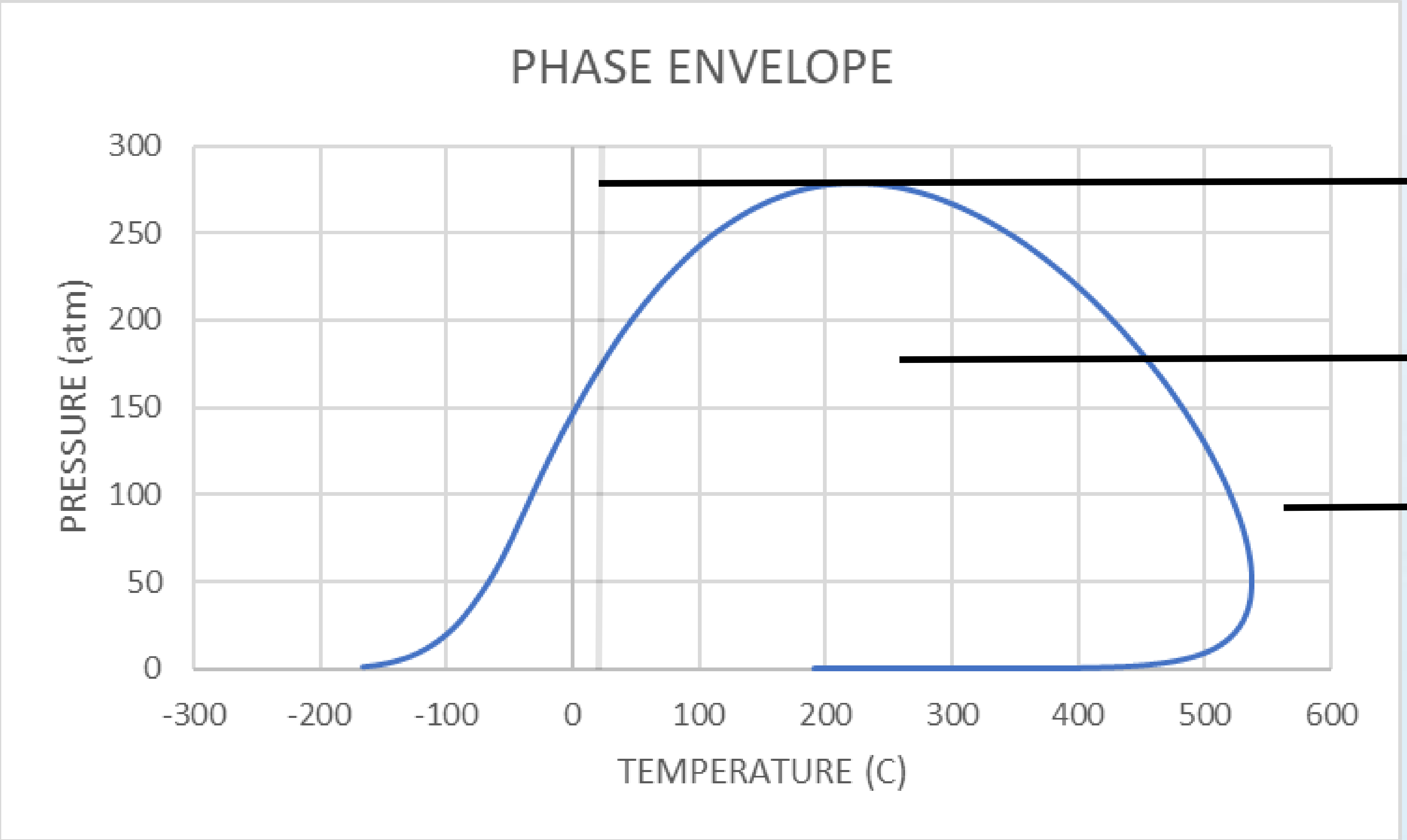
WAX PRECIPITATION

- As the temperature decreases the amount of wax formation increases
- The temperature below which the wax starts appearing is the WAT
- As the pressure increases the amount of wax formation decreases

ASPHALTENE PRECIPITATION

- AOP - The pressure at which asphaltene precipitation occurs at a given temperature.
- As the pressure decreases the asphaltene precipitation increases till bubble point
- Pressure below bubble point, asphaltene deposition starts to decrease

MULTIPHASE FLOW



SINGLE PHASE LIQUID REGION

TWO PHASE REGION (OIL + GAS)

SINGLE PHASE GAS REGION

FLOW REGIMES (VERTICAL PIPE)

- Bubble Flow
- Slug Flow
- Churn Flow
- Annular Flow

- When the pressure and temperature of the crude reduces, gas starts evolving out of oil creating two phase flow in the pipelines
- Due to high velocity of gas, it blocks the passage of oil creating different flow regimes and ultimately reducing production

INPUT TOOLS & FUNCTIONS

PIPELINE GEOMETRY DATA

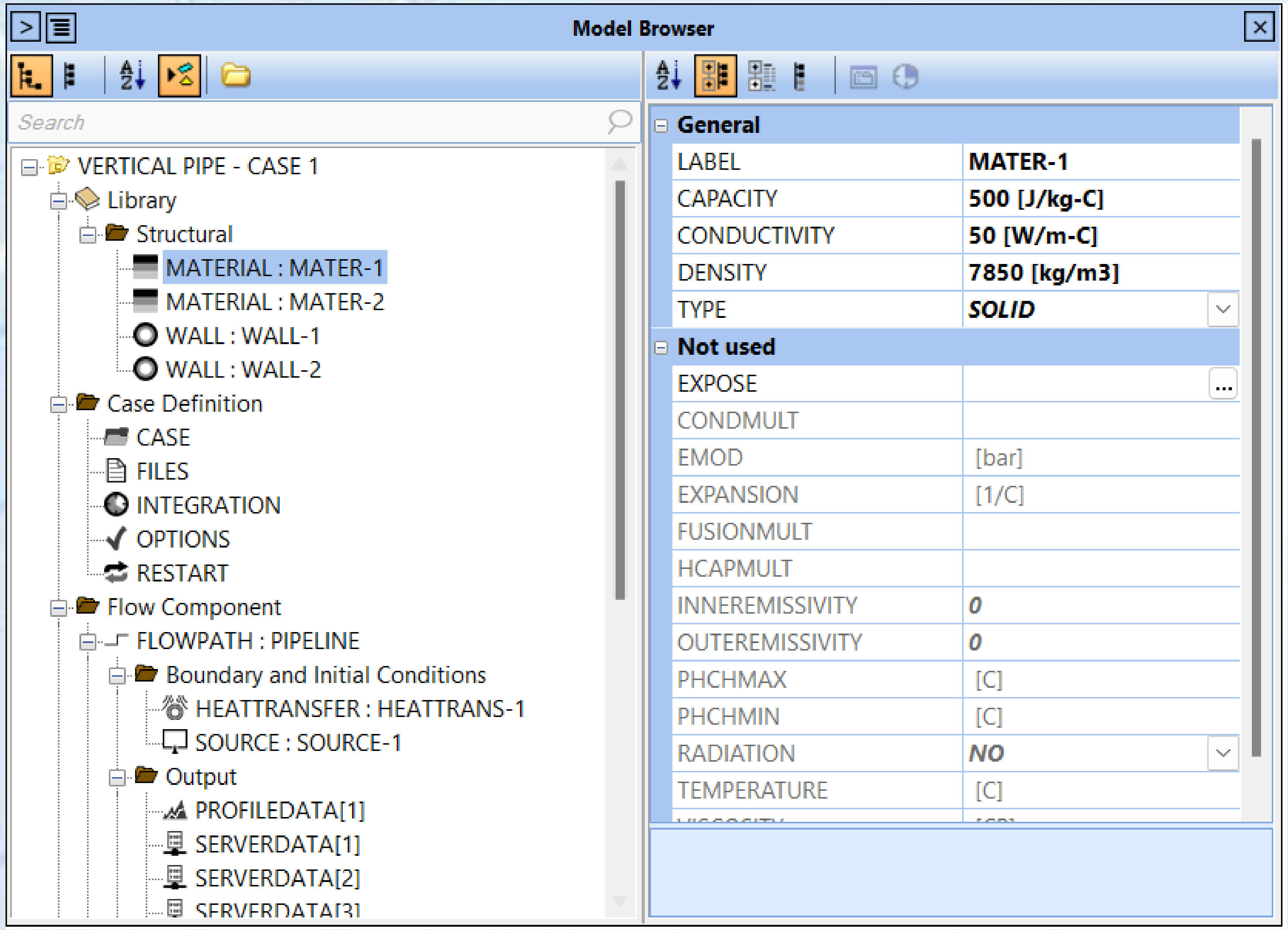
LENGTH	400 m
ELEVATION	400 m
SECTIONS	1
DIAMETER	0.12 m
ROUGHNESS	5 x 10^-5 m

MODEL BROWSER

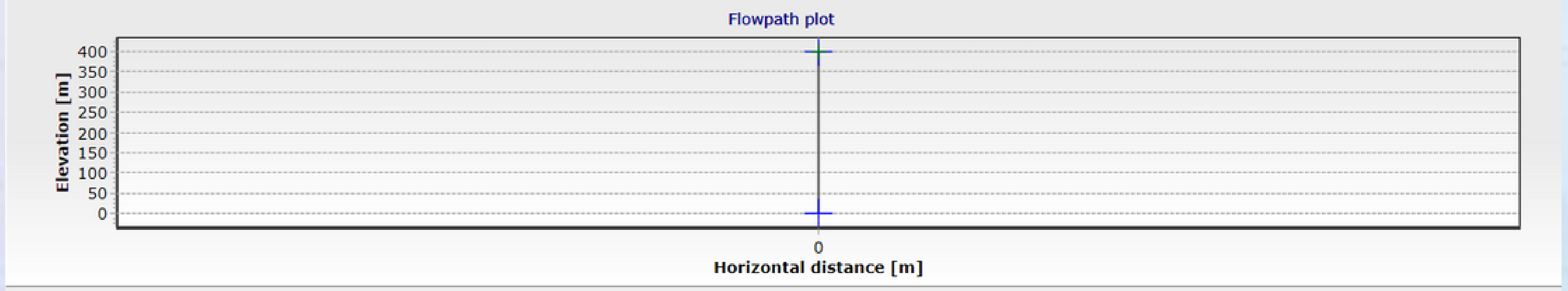
STRUCTURAL	• MATERIAL • WALL
CASE DEFINITION	• PVT FILE • WAX FILE • ASPHALTENE FILE
FLOW COMPONENT	• MASS FLOW RATE • TEMPERATURE • PRESSURE
OUTPUT	• INTEGRATION TIME • VARIABLES • PROFILE DATA • TREND DATA

COMPONENTS

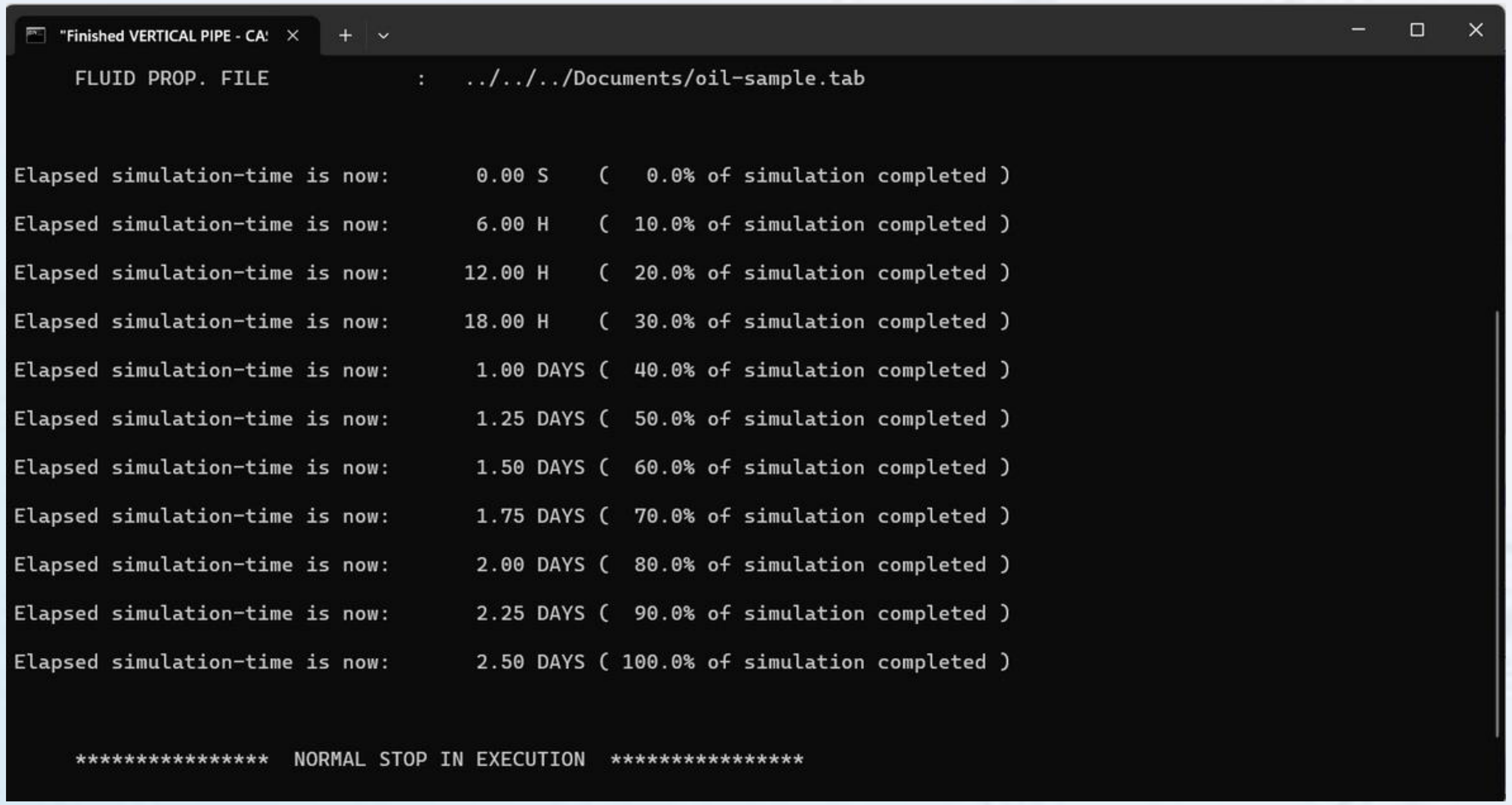
INLET	CLOSED NODE
OUTLET	PRESSURE NODE
SOURCE	MASS FLOW
HEAT TRANSFER	OVERALL U VALUE



STEP 1 - INPUT DATA IN MODEL BROWSER



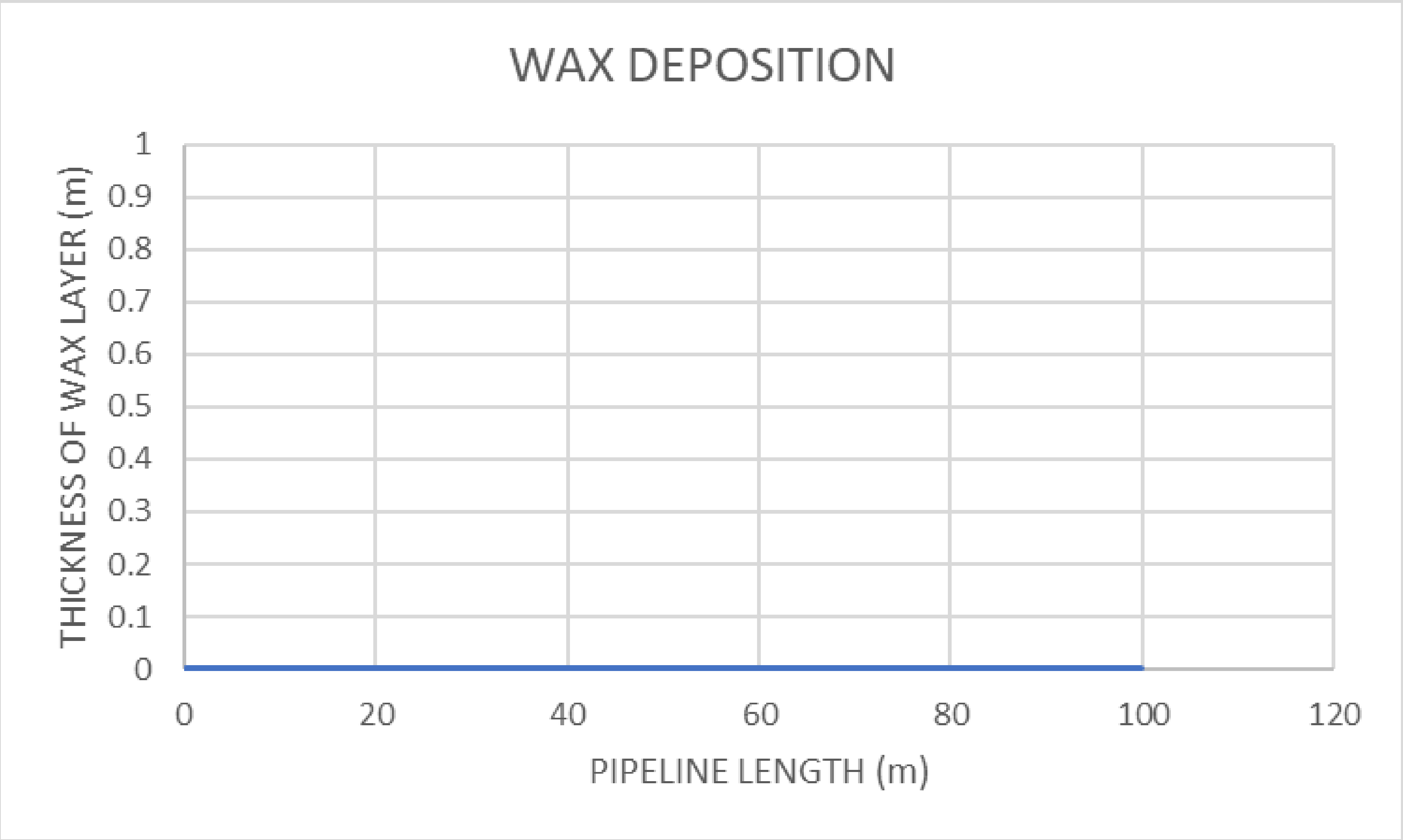
STEP 2 - DEFINE PIPELINE GEOMETRY

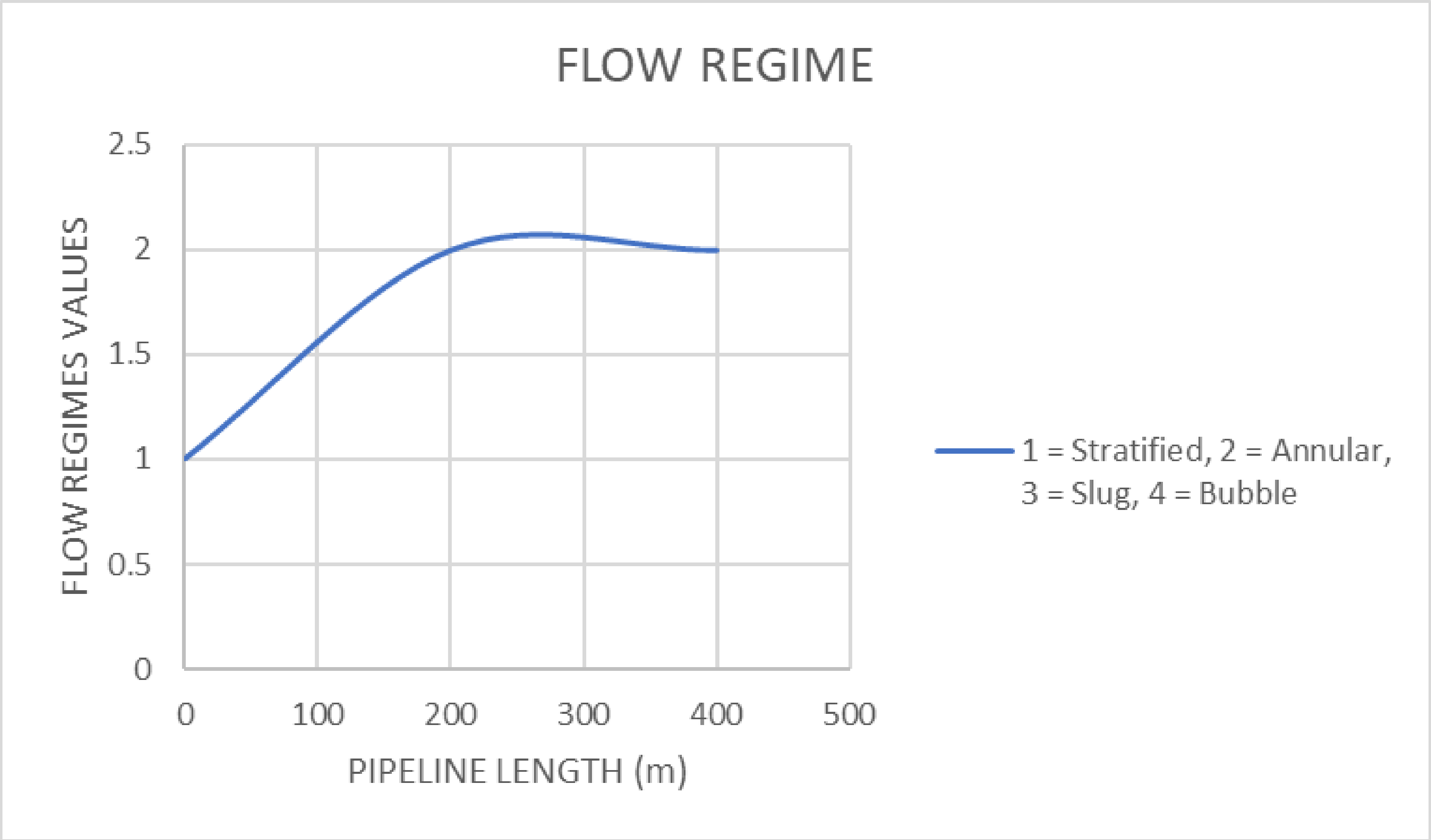


STEP 3 - RUN SIMULATION

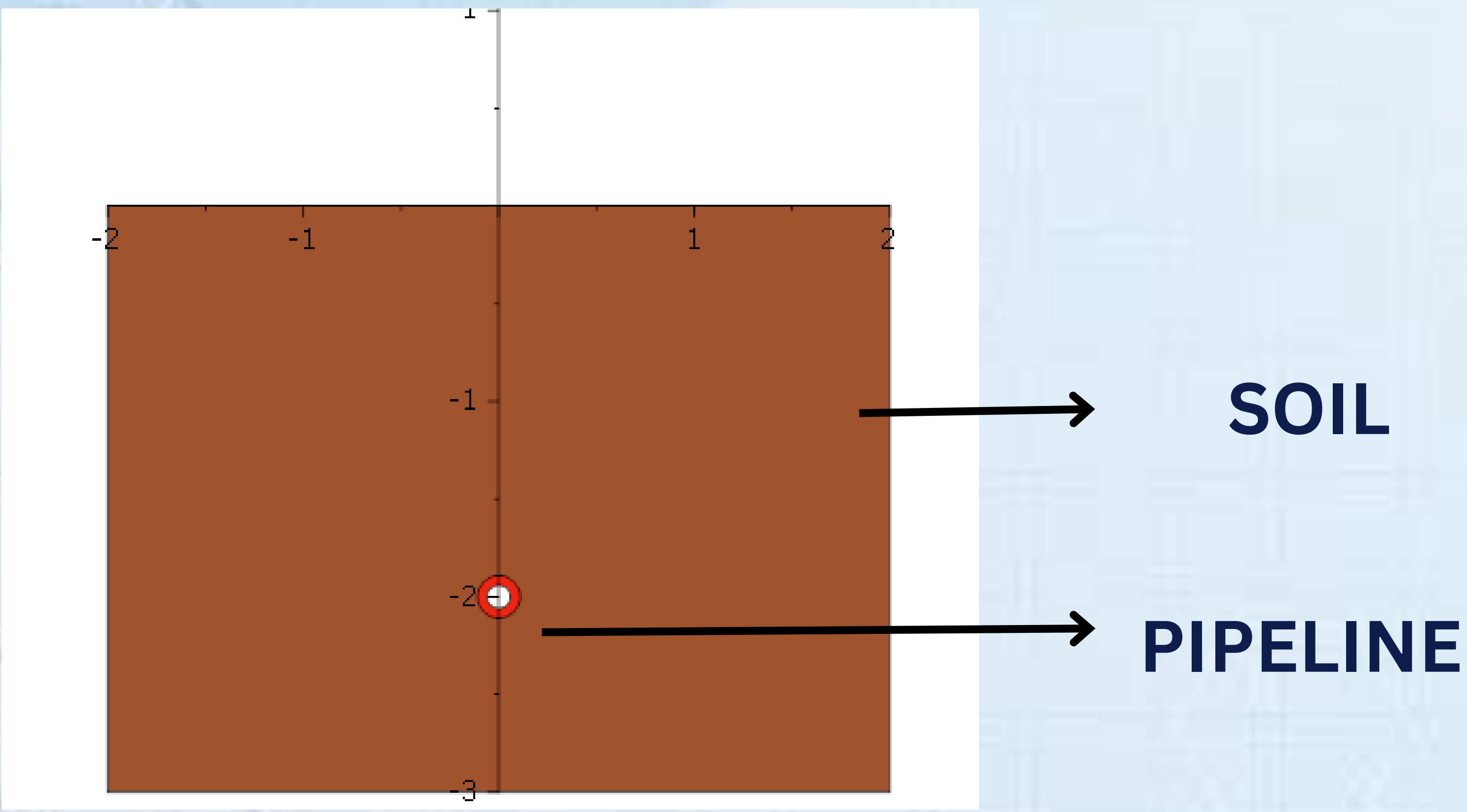
OBSERVATIONS

CASE 1 - NO WAX DEPOSITION

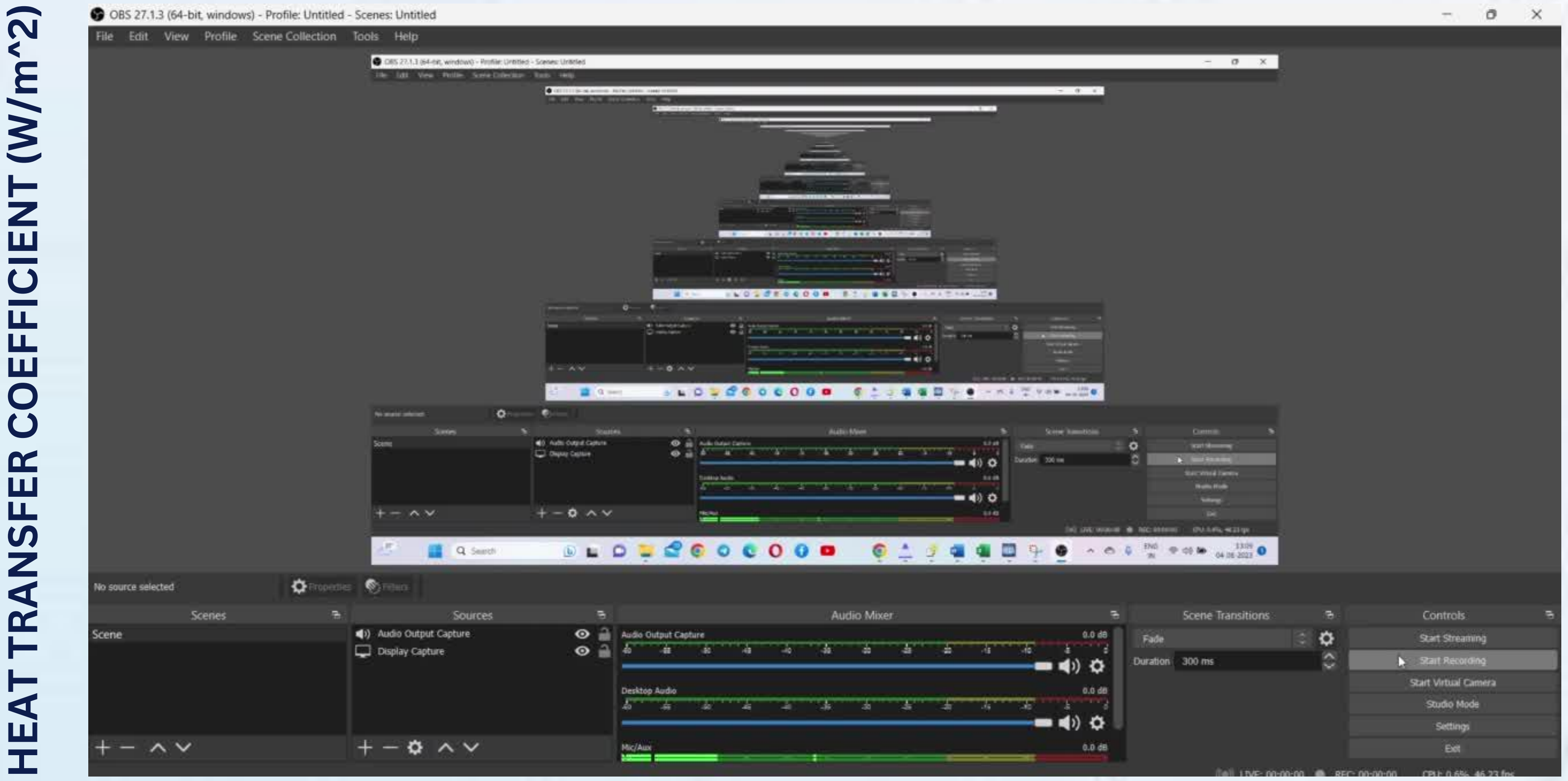




EFFECT ON HEAT TRANSFER COEFFICIENT



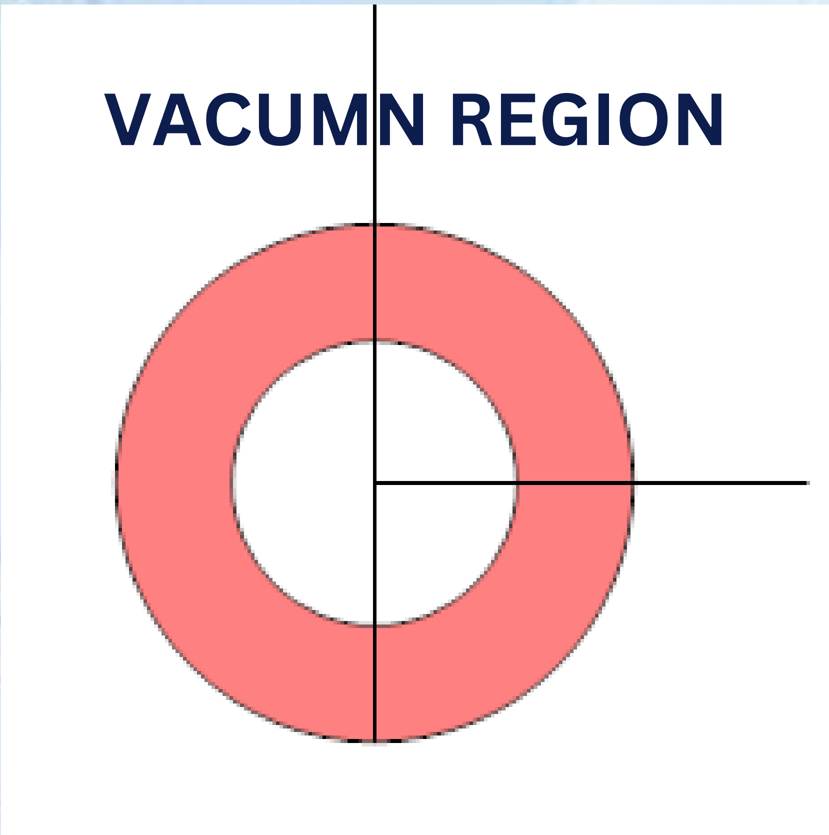
PIPELINE BURRIED UNDER THE SOIL



PIPELINE LENGTH (m)

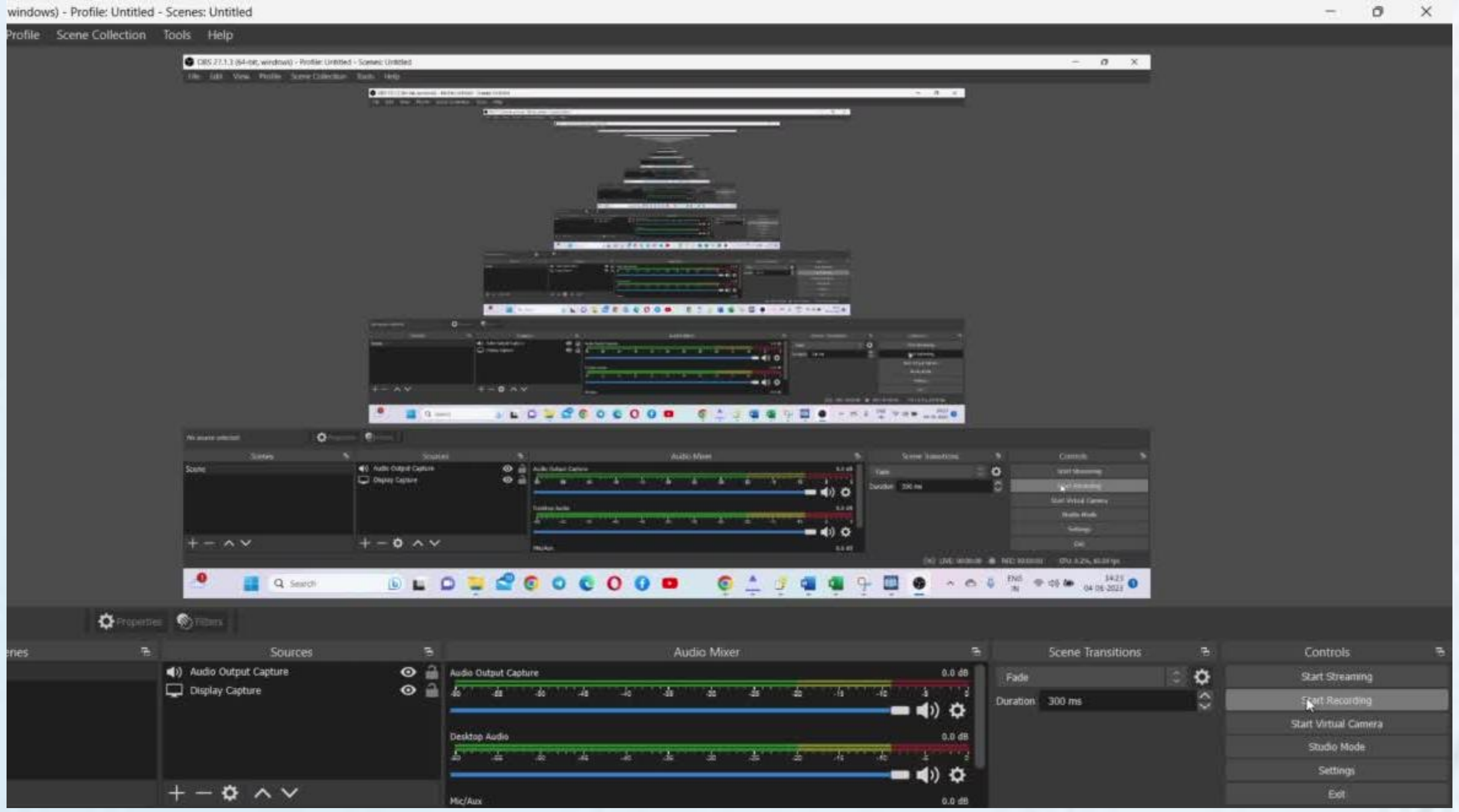
- Overall Heat Transfer coefficient increases with increase in flow rate
- Its affected by the surrounding environment and thermal conductivity of soil

EFFECT ON HEAT TRANSFER COEFFICIENT



PIPELINE ABOVE SOIL

HEAT TRANSFER COEFFICIENT (W/m^2)



PIPELINE LENGTH (m)

- The value of overall heat transfer coefficient is less when compared to the pipeline burried under the soil
- Heat transfer in vacumn < Heat transfer in soil