User Guide for iPhone & iPod Touch

Introduction

iPhone 4 x iPhone 5

Main Menu

Data Files

Importing from Other Apps

Unit Systems

Well Configuration

Main View

Circulation Options

Timer / Pause

Set/Reset Alarms

Graph Options

Drilling Simulation

Restart

Send Screenshot by Email

About

Revision using version: 1.5 with iOS 6.1

Available on the App Store

1) Panel with the following parameters: pump pressure, mud pump speed, strokes totalizer, flow rate, mud weight, bit depth, rotary speed, hookload and weight on the bit;
2) Instruments with pointers to the parameters: pump pressure, hookload, weight on the bit and rotary torque;
3) Geolograph with parameters: drillpipe pressure, choke pressure, active volume, hookload, weight on the bit, length drilled, flow in, flow out, percent of flow, rotary torque, rotary speed and drilling rate.
4) Panel with alarms: pump failure, vol high, flow high, bop failure, bop status and choke status;
5) Toolbar with buttons: Well Config, Circulation Options, Set Alarms, Graph Limits, X-times faster, Pause/Continue, Restart, Send by email, about;
6) set drillstring with drillpipe1, drillpipe2, heavy-weight, drillcollar1 and drillcollar2;
7) Select floating rig or land rig;
8) Select unit systems: International, field1 (imperial) and field2 (mix);
9) set fluid parameters: mud weight, plastic viscosity, yield point and initial gel;
10) Select rheological models: Power or Bingham;
11) Set gradients: absorption, fracture and temperature;
12) Set jet nozzles or fixed TFA;
13) Set choke parameters and BOP test pressure;
14) Set Surface circulation volume;
15) Set surface circulation equipments (mud pump and lines);
16) Set four formations to drilling (height, pore gradient, fluid density and sof/hard);
17) Save configuration to data files and share by iCloud;
18) Select circulation options: drillpipe -> Riser, Kill -> Riser, and Close BOP;
19) Set alarms: pit gain, flow rate out, max pump pressure and max pump power;
20) Register the kill line losses and pump pressure at the kill speed;
21) show the well with drillstring and the drillbit on rotating;
22) Show schematic of well with drillstring, kick and neutral point (%);
23) Adjust pump speed, weight on the bit and rotary speed to drilling until kick detection;
24) Shut-in the well using hard method;
25) Register shut-in drillpipe pressure (SIDPP) and choke pressure (SICP) and gain volume;
26) behavior of the kick: keeping the well closed and keeping the well opened;
27) Simulations: Drilling, Kick detection, Shut-In, Underground Blowout at shoe and blowout with failure of bop;
28) Capacities and Volumes calculations;
29) Hydrostatic and critical pressures calculations;
30) Hydraulics calculations;

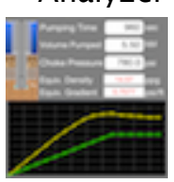
Note: This Drilling Simulator NOT allows to control the well after the kick detection and shut-in. The simulation ends after the simulations of underground blowout and blowout to surface. **Use other apps for:**

Well Control Simulator

Well Control Methods

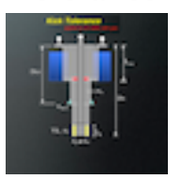
Leak-Off Test Simulator

Leak-Off Test Analyzer



Drilling Hydraulics

Kick Tolerance

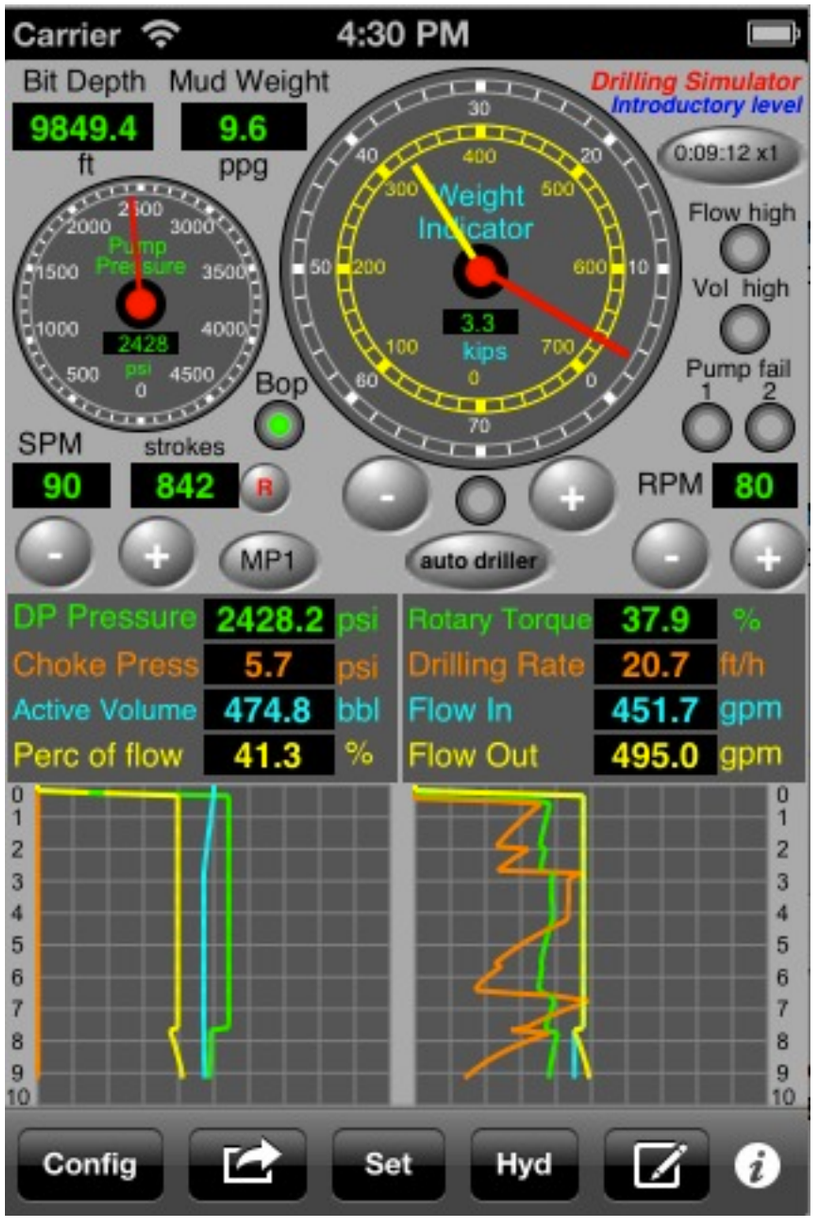


Directional Survey

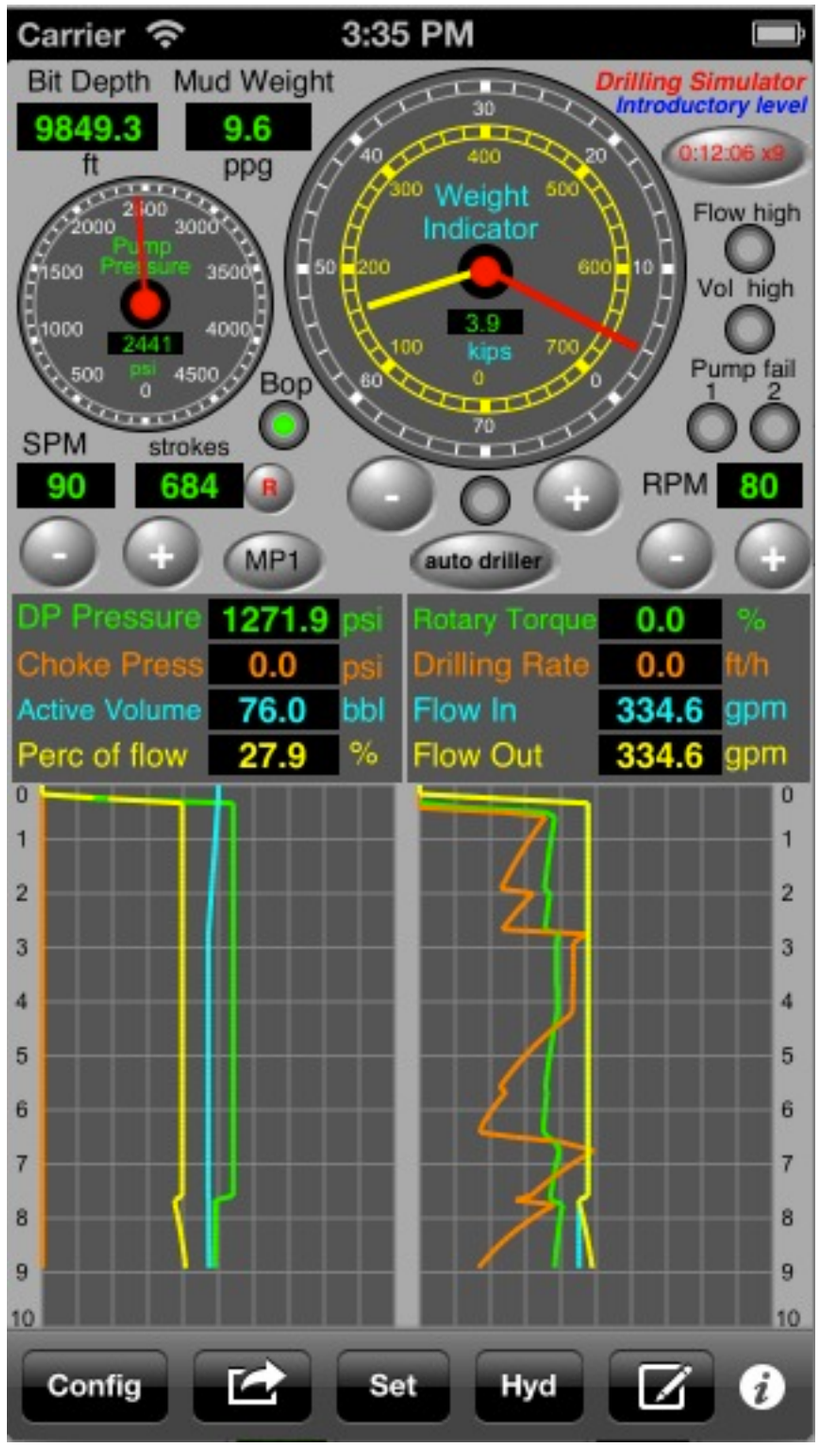
Drilling Cost

Website

iPhone 4

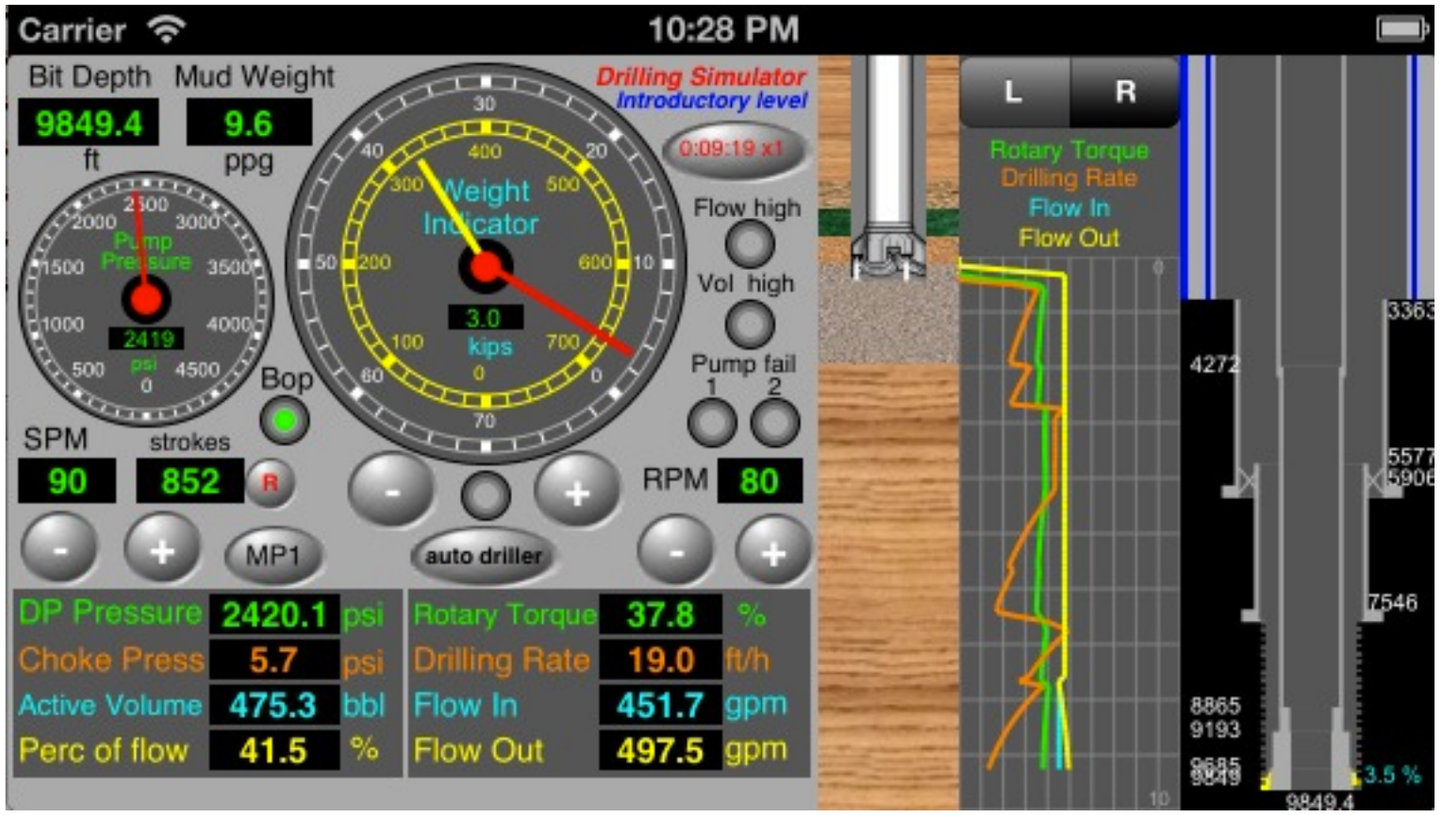


iPhone 5



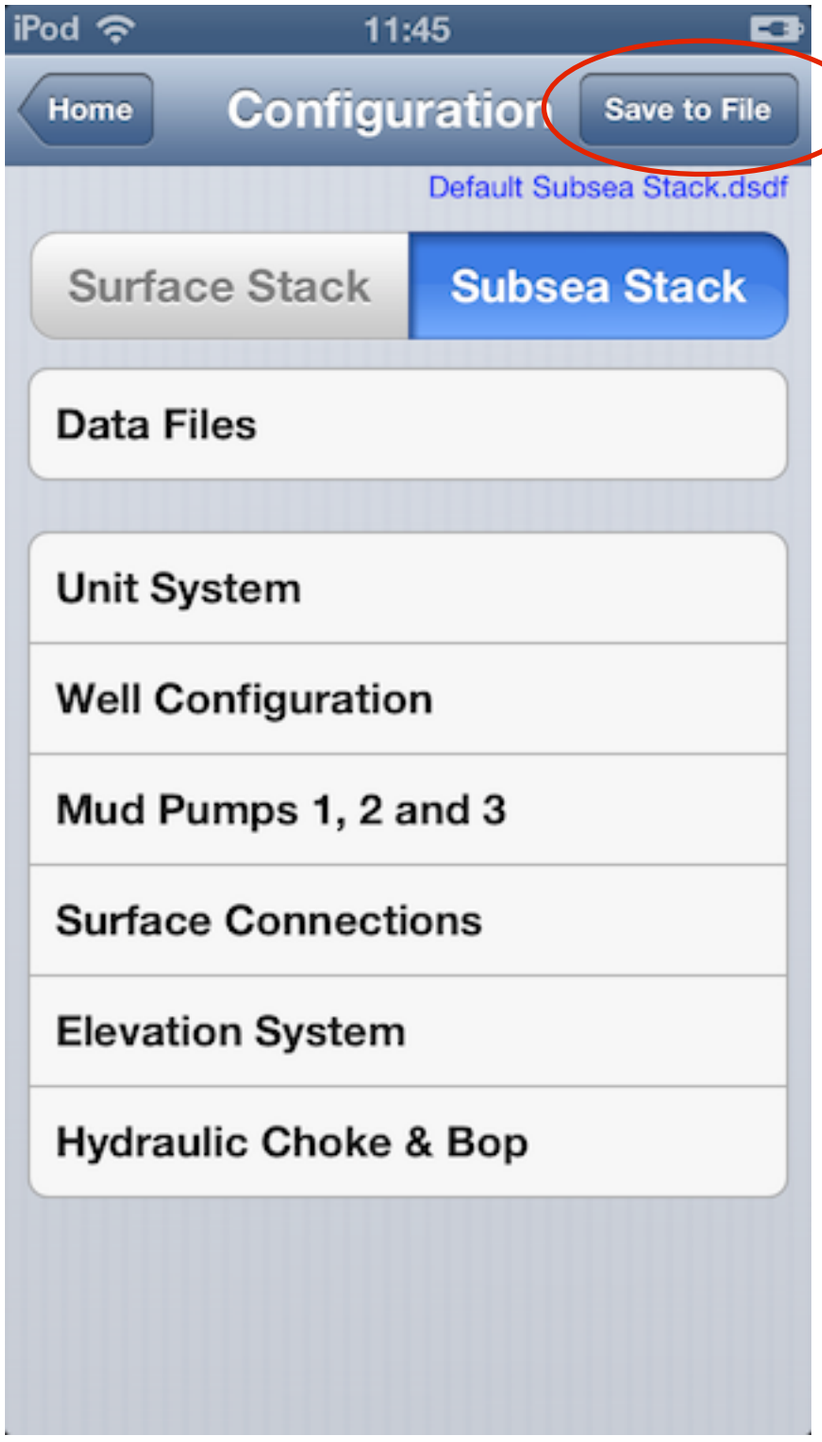
iPhone 4

iPhone 5



iPhone on vertical position

Visible when a data file is selected



Surface Stack:
Land rig
and Jack-up

Subsea Stack:
Semi-submersible
and Drillship
(floating rigs)

Data Files Interface

iCloud Settings

Data Files on iCloud

Creating a New Data File

Saving the New Data File

Default Surface Stack

Default Subsea Stack

Opening a Data File

Saving a Data File

Removing a Data File

Sending a Data File by Email

back to main menu

Edit file name

Select local option

Import from other apps

Save data file

Select data file

Current data file (selected)

Remove data file

Default landing data file

Open data file

Default subsea data file

Send data file by email

It's recommended first create a data file for work with this app => The "Save" button is enabled on views.
But this is unnecessary because this app uses data in the ram memory. The data can be saved on any time.

First, use the Local Option for create data files for better performance and later to save it on iCloud.

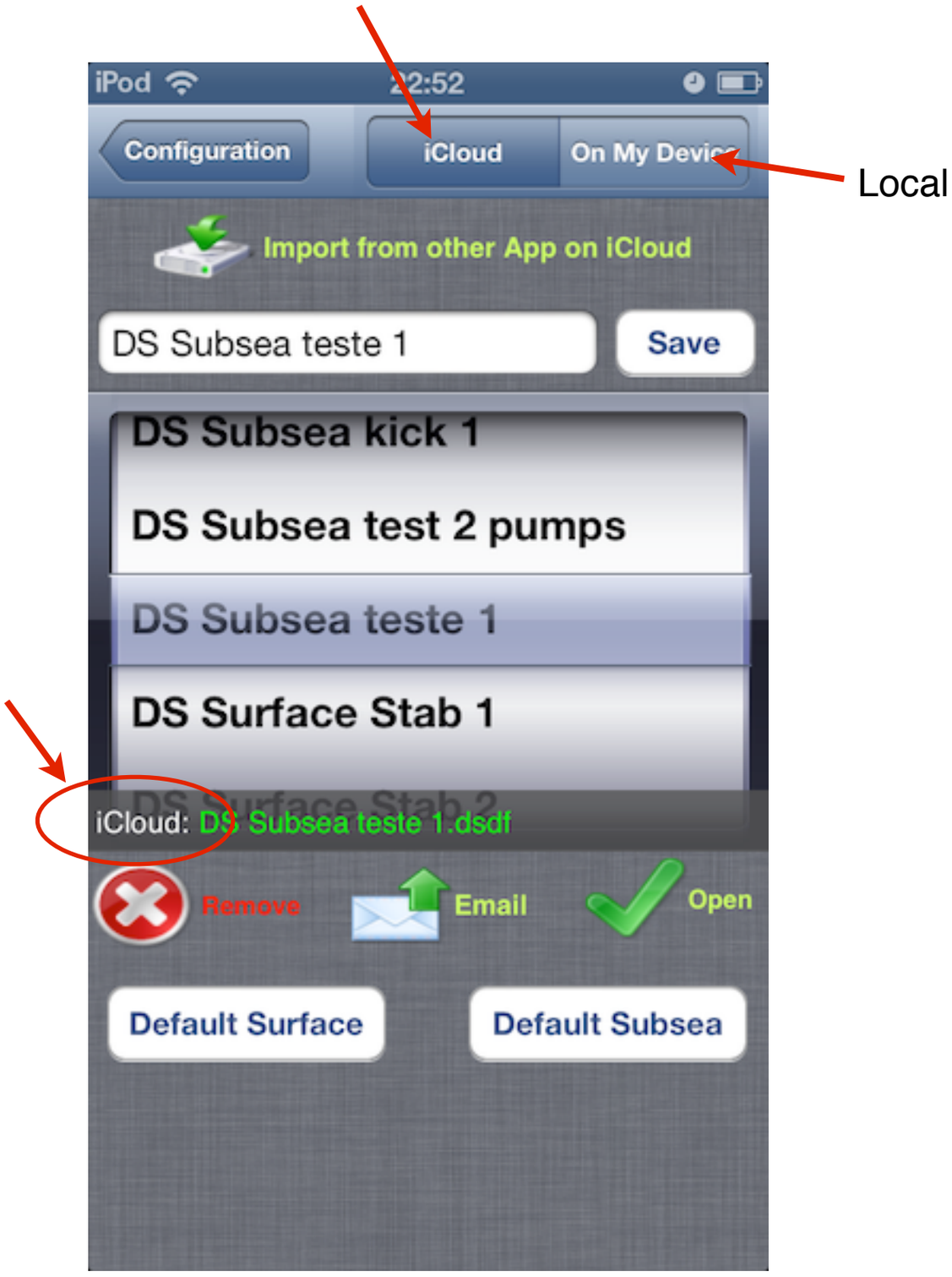
for iCloud unavailable

Disabled

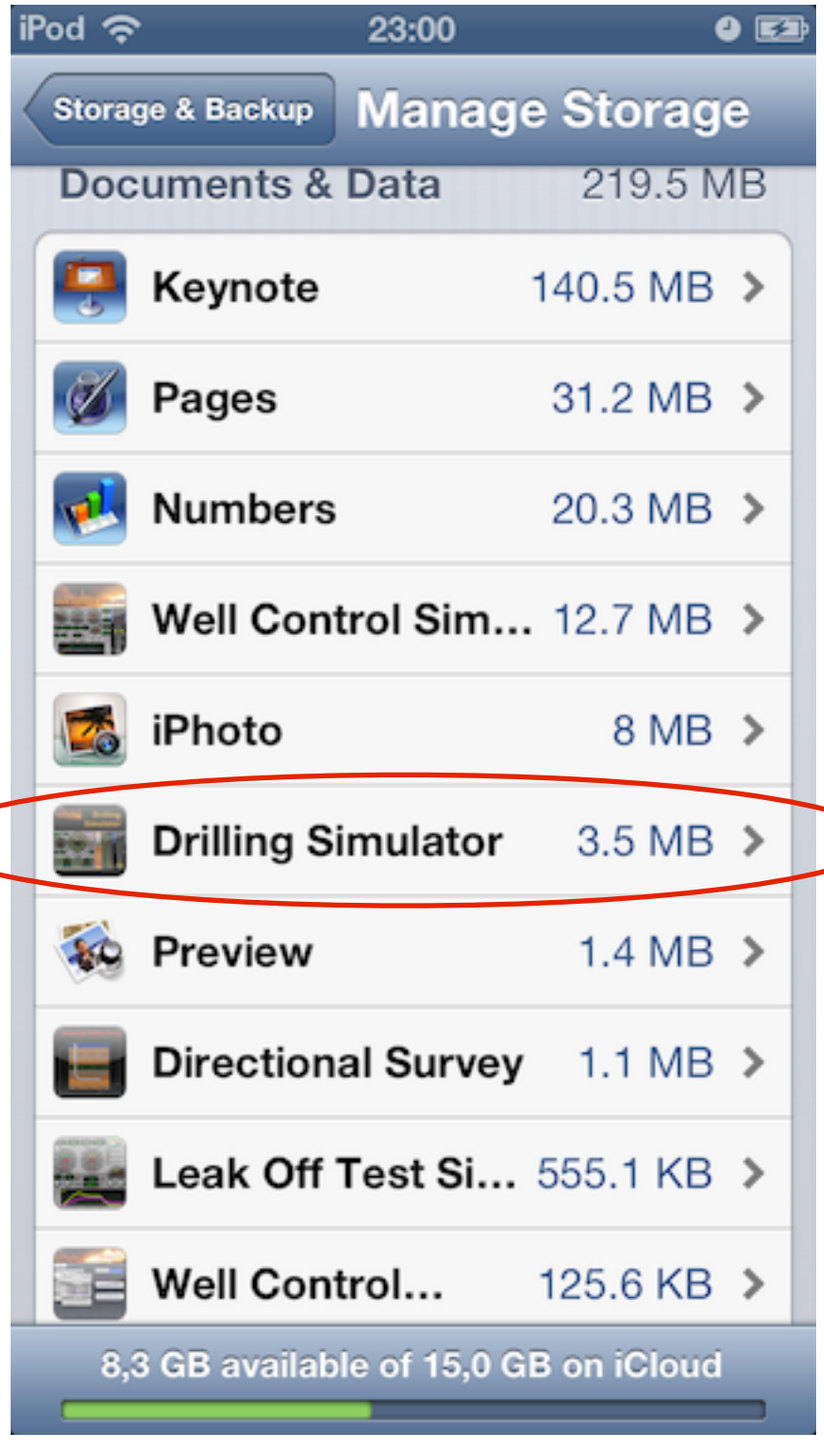
Check iCloud Configuration: **Settings => iCloud**

Documents & Data must be ON

If iCloud is available on iPhone:



After create any data file in iCloud:
Settings => Storage & Backup => Manage Storage

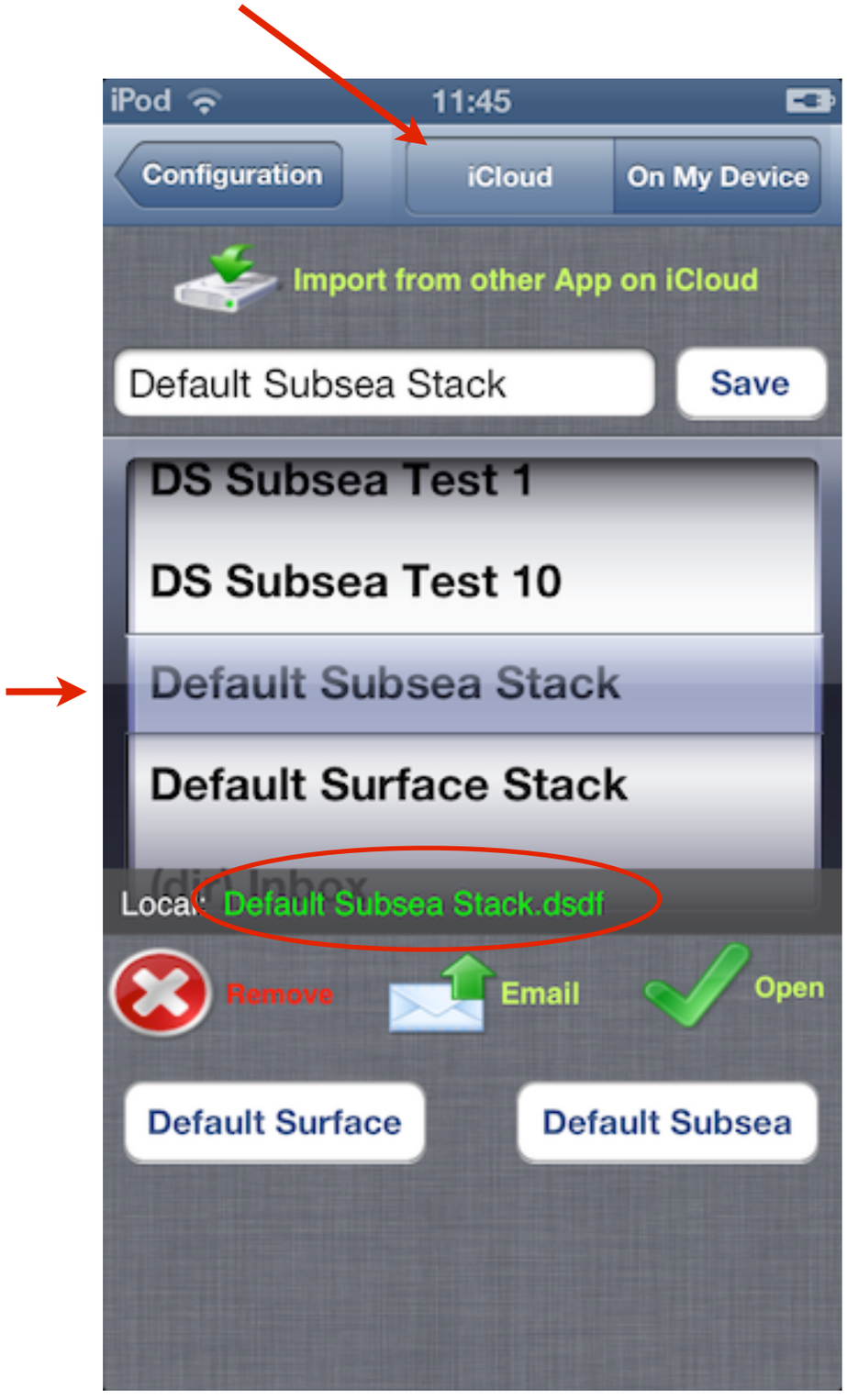


This application needs a complete well to work.
For create a new Data File, select a default well on buttons “**Default Surface**” or “**Default Subsea**”

File extension:

This application uses the file extension ***.dsdf** (Drilling Simulator Data File). The user does not need to edit this extension.

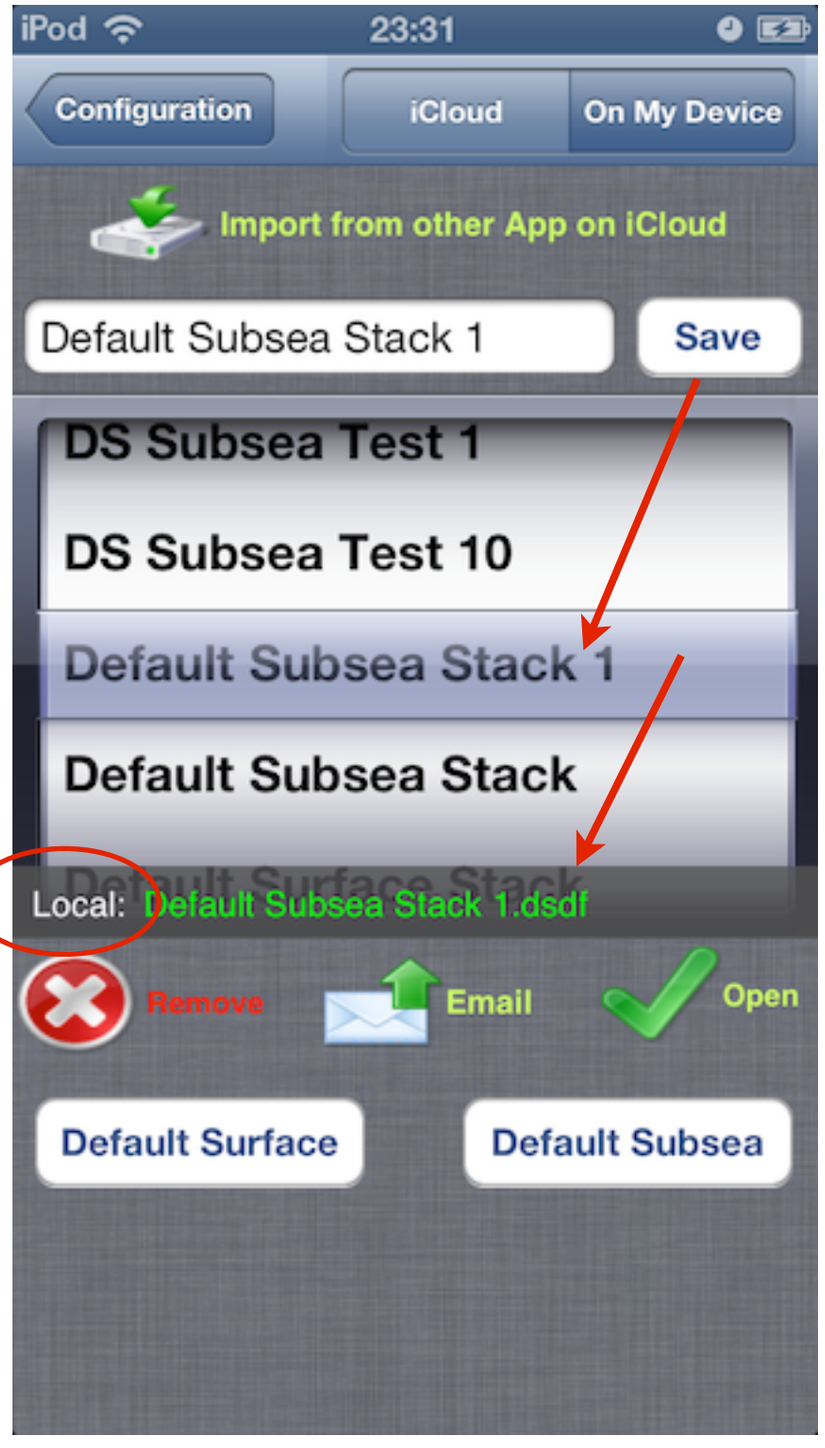
The data file is saved with the default name (ex. **Default Subsea Stack**) on **iCloud** or **On My Device** according to the selected option.



Save the data file with other name. Input the file name and Tap on "**Save**" button

Hide Keyboard

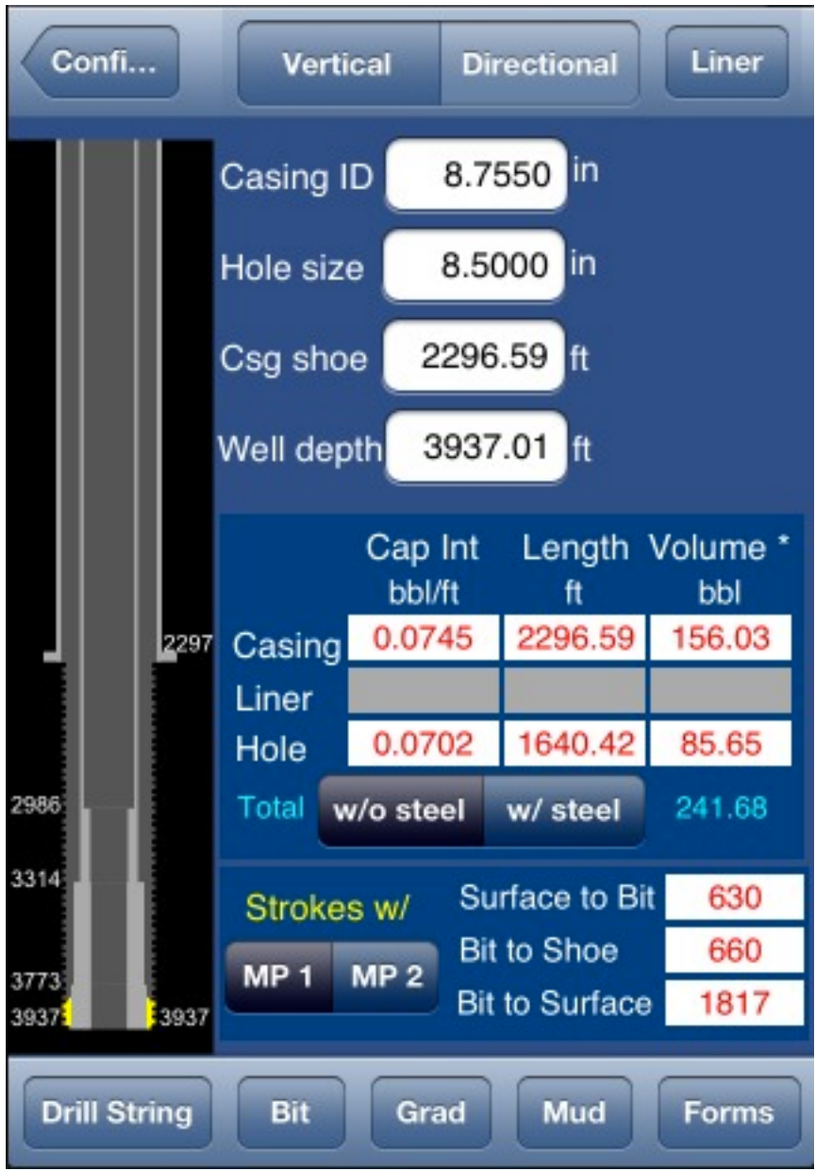
The new data file is saved on **iCloud** or **On My Device** according to the selected option.



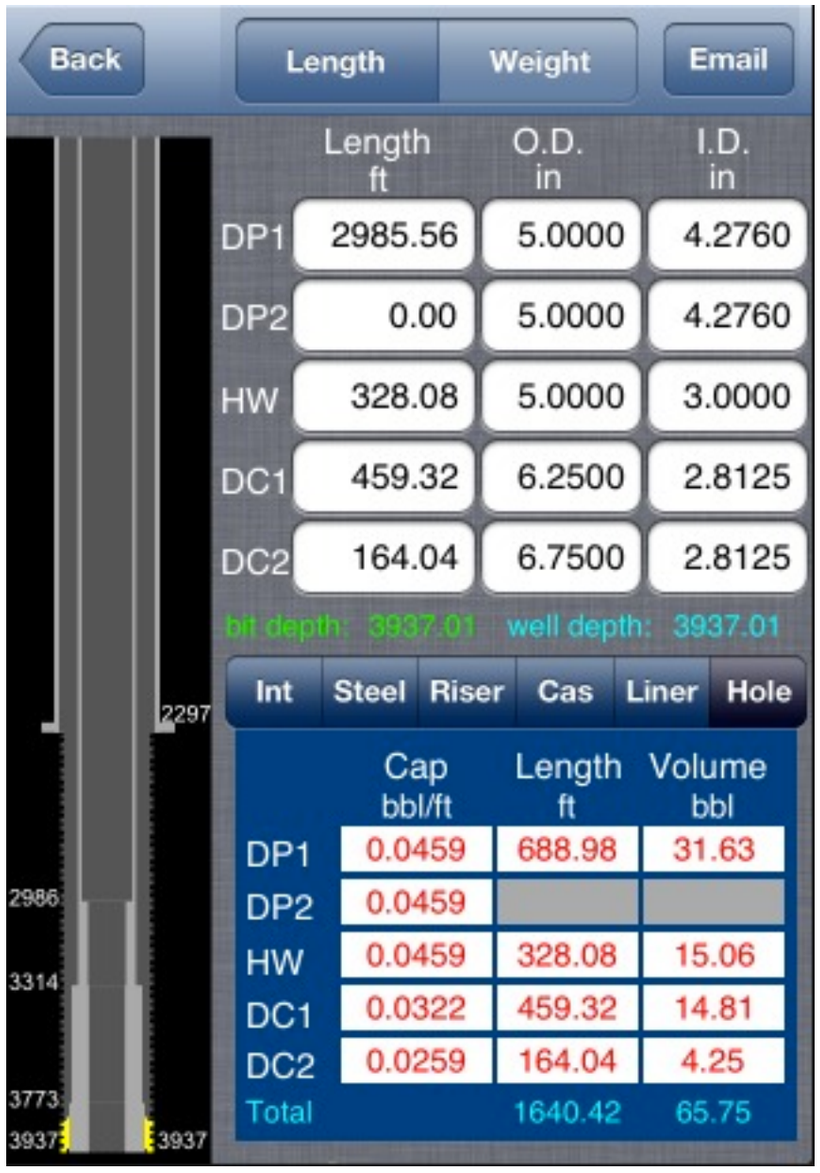
iCloud
Local
No File

Local → On My Device

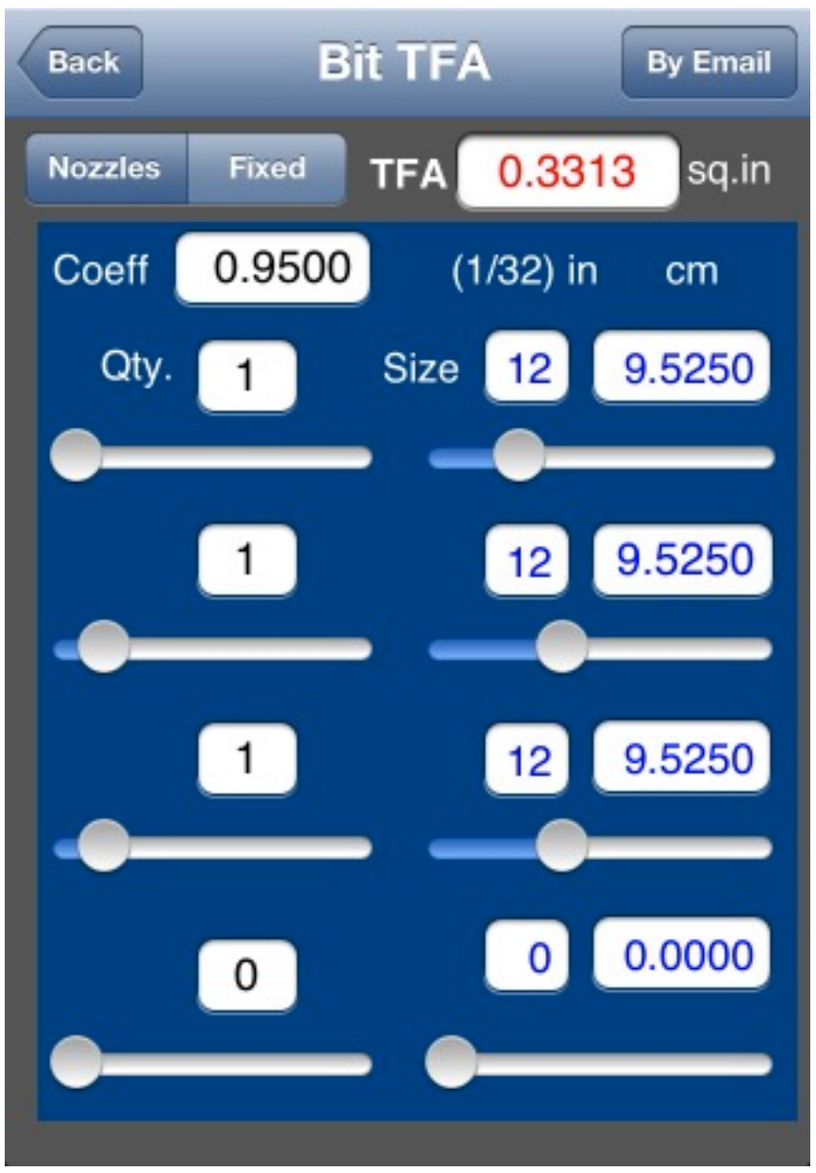
Well Configuration



Drill String

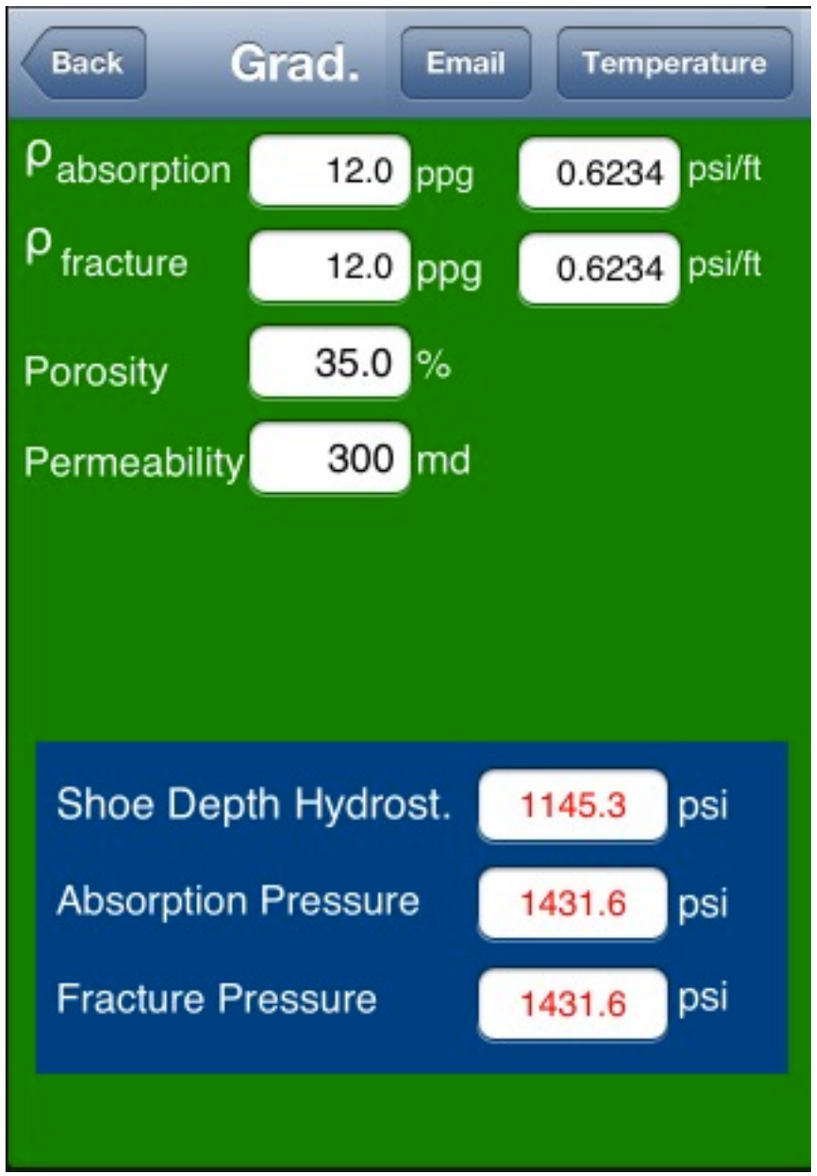


Drill Bit

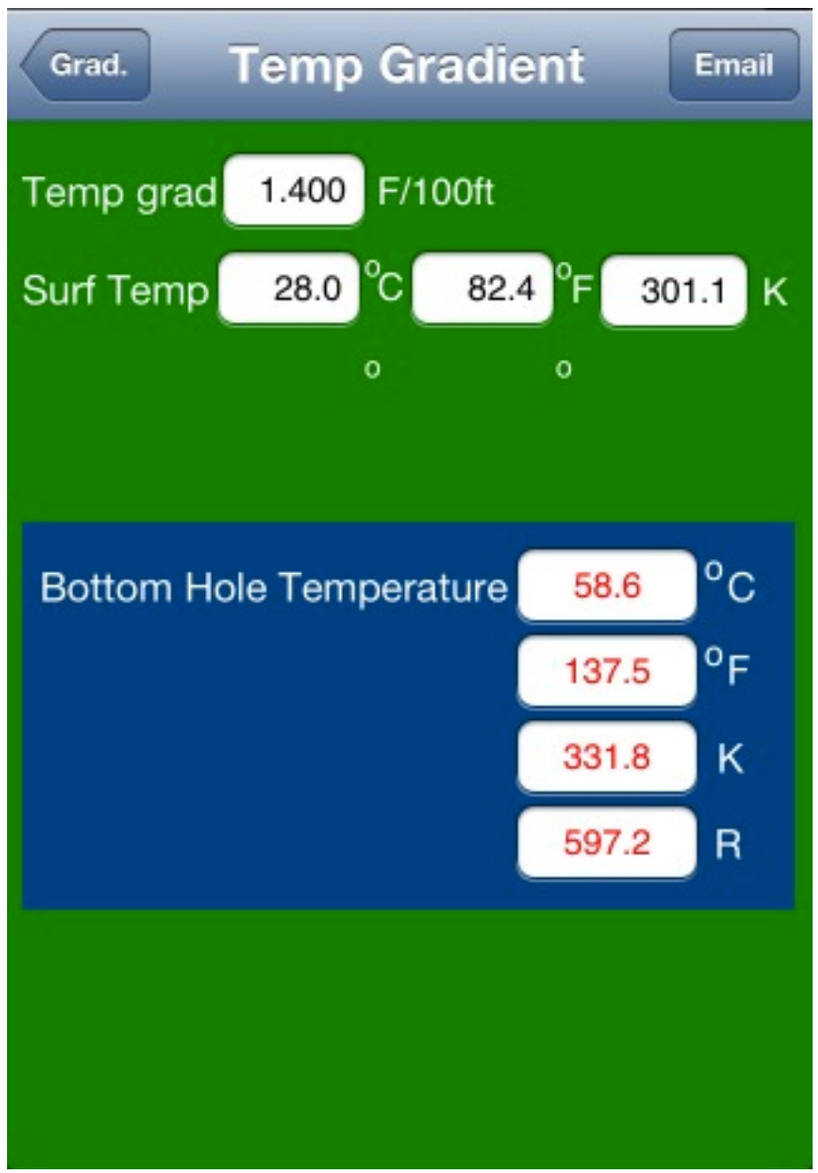


Note: screenshots with iPhone 4

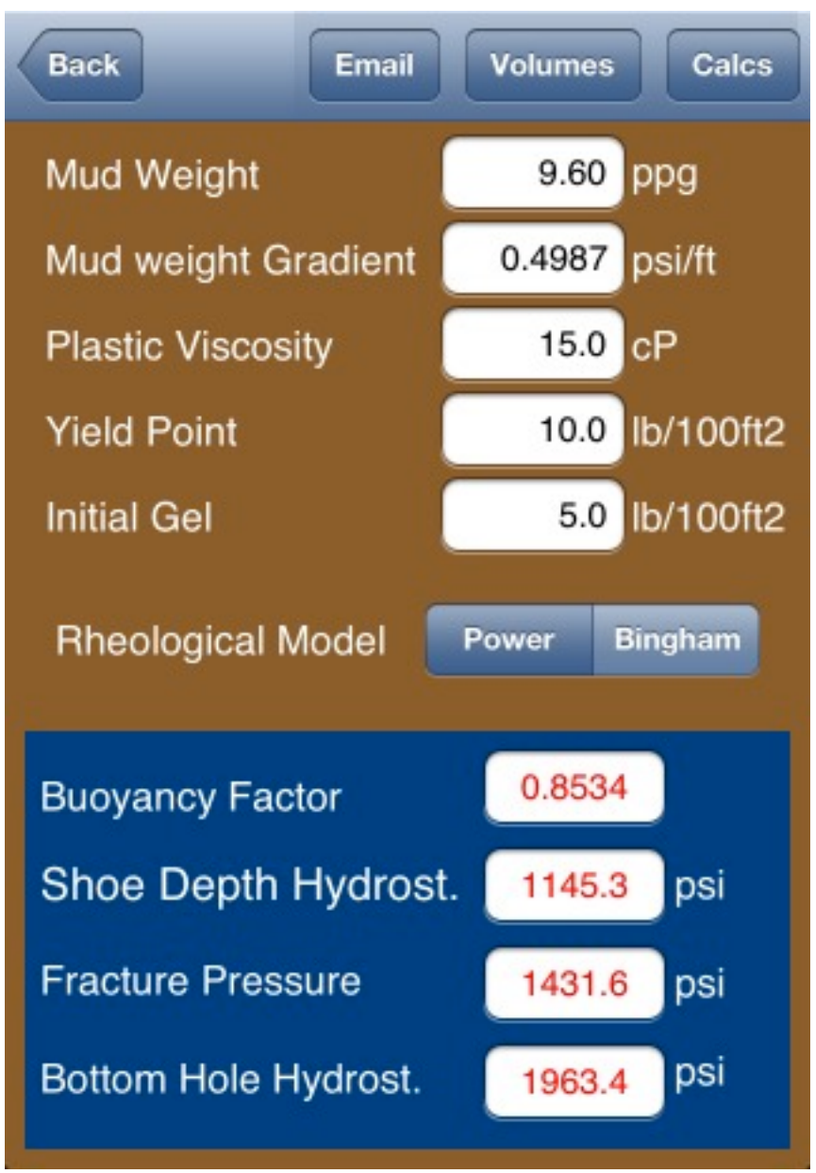
Gradients



Temperature Gradient

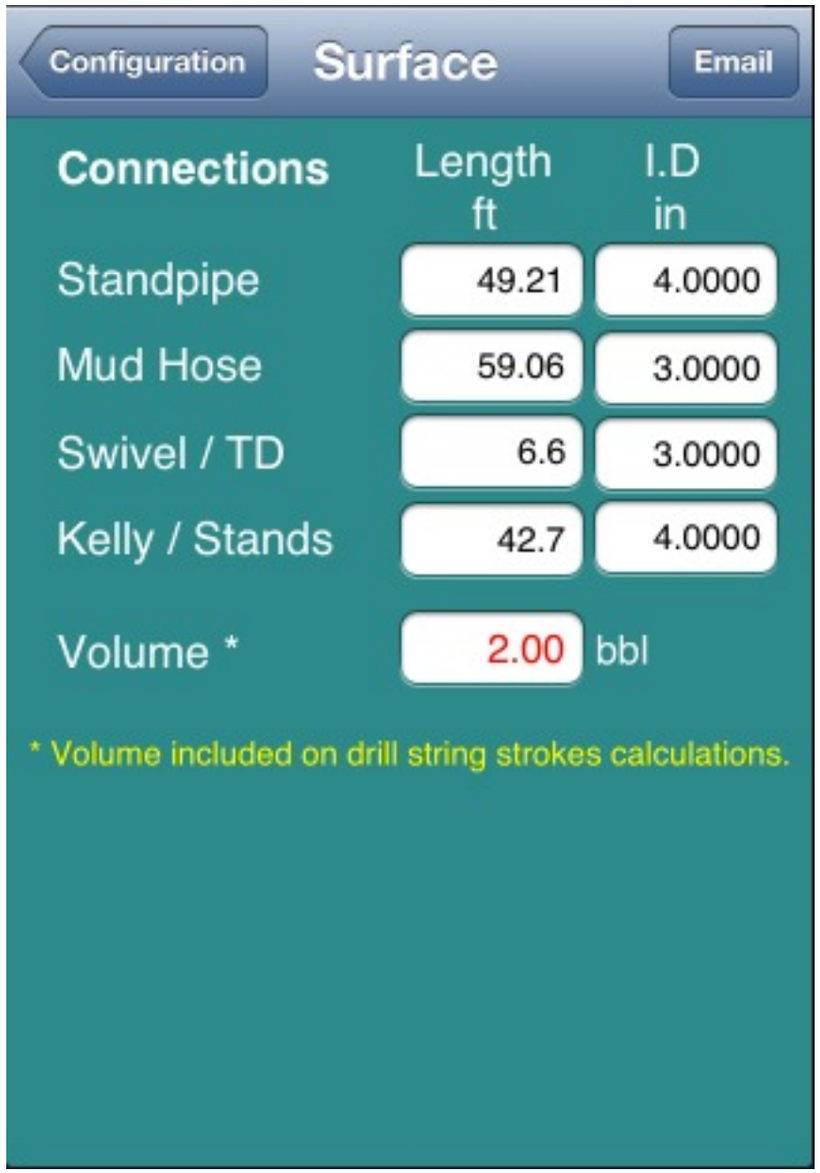


Mud

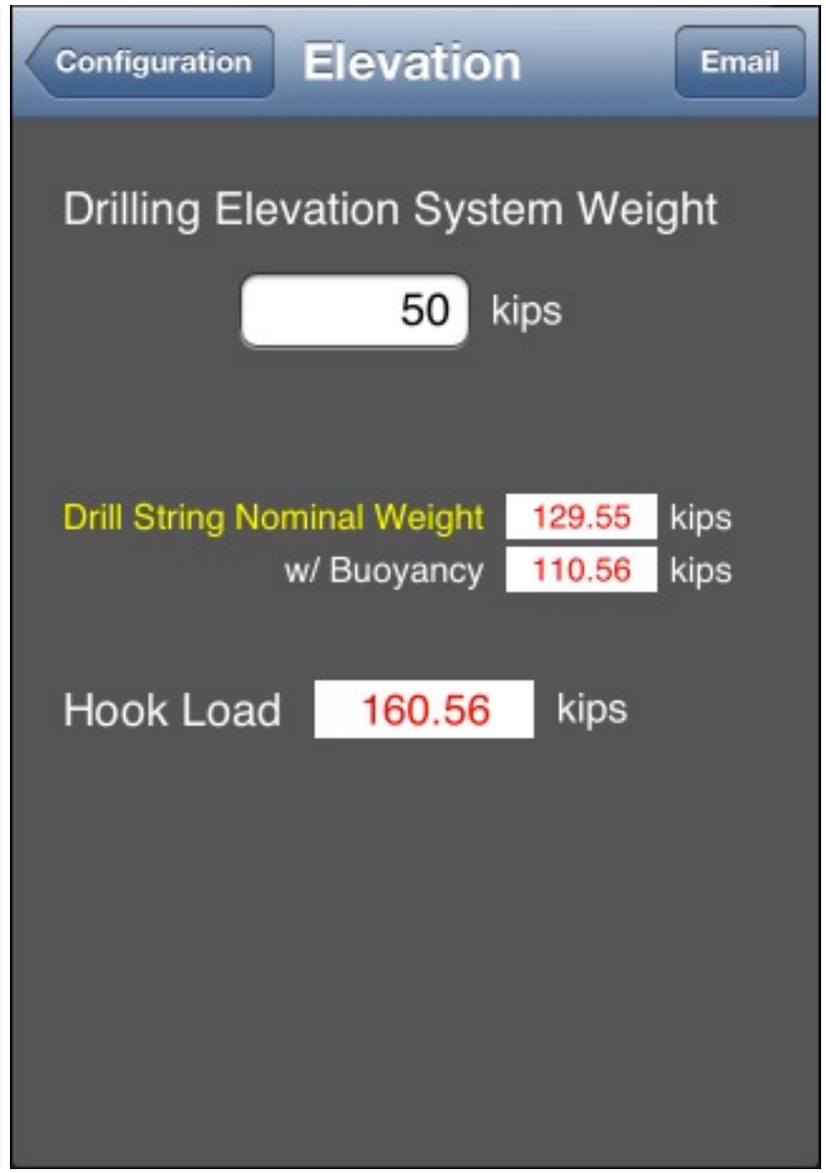


Mud Pumps

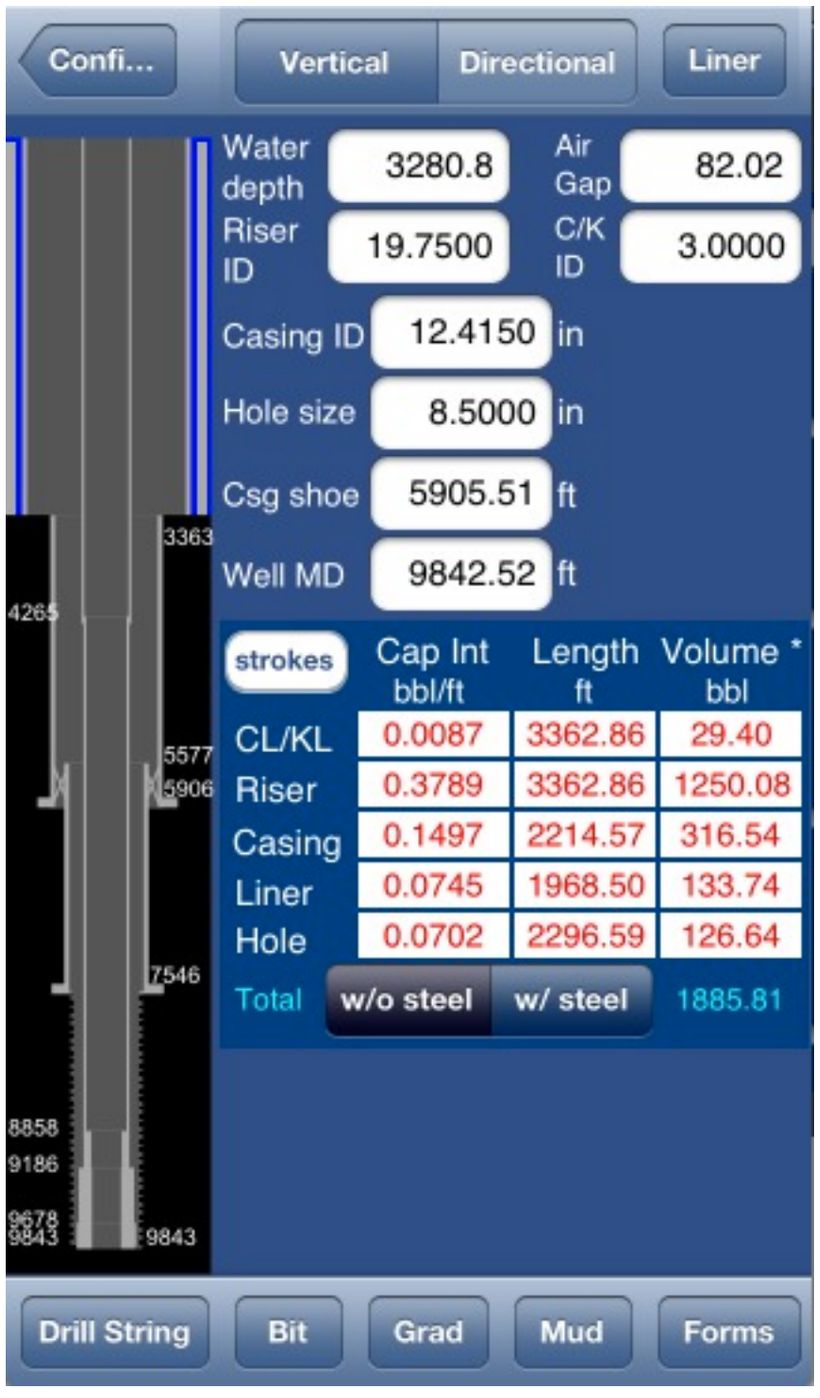
Surface Connections



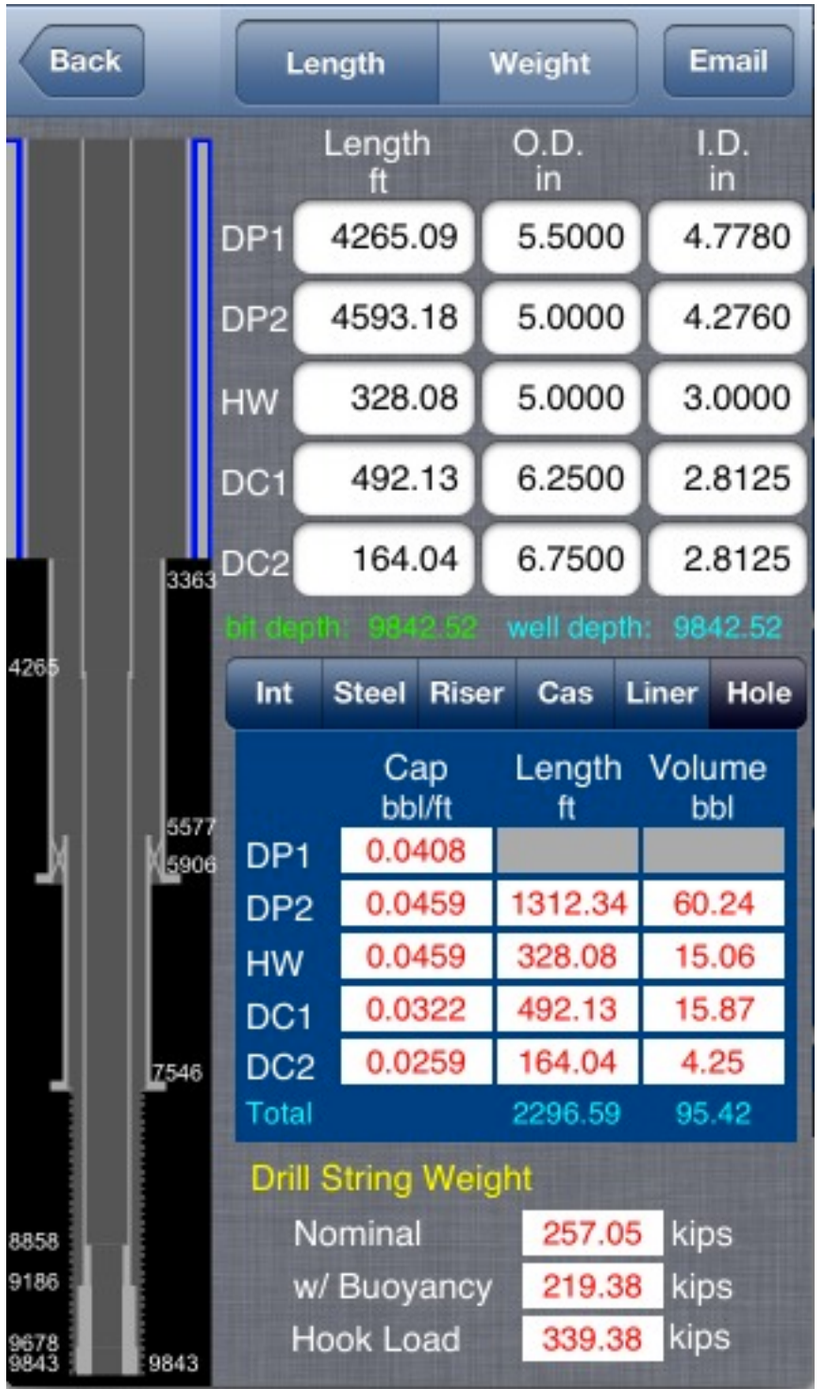
Elevation System



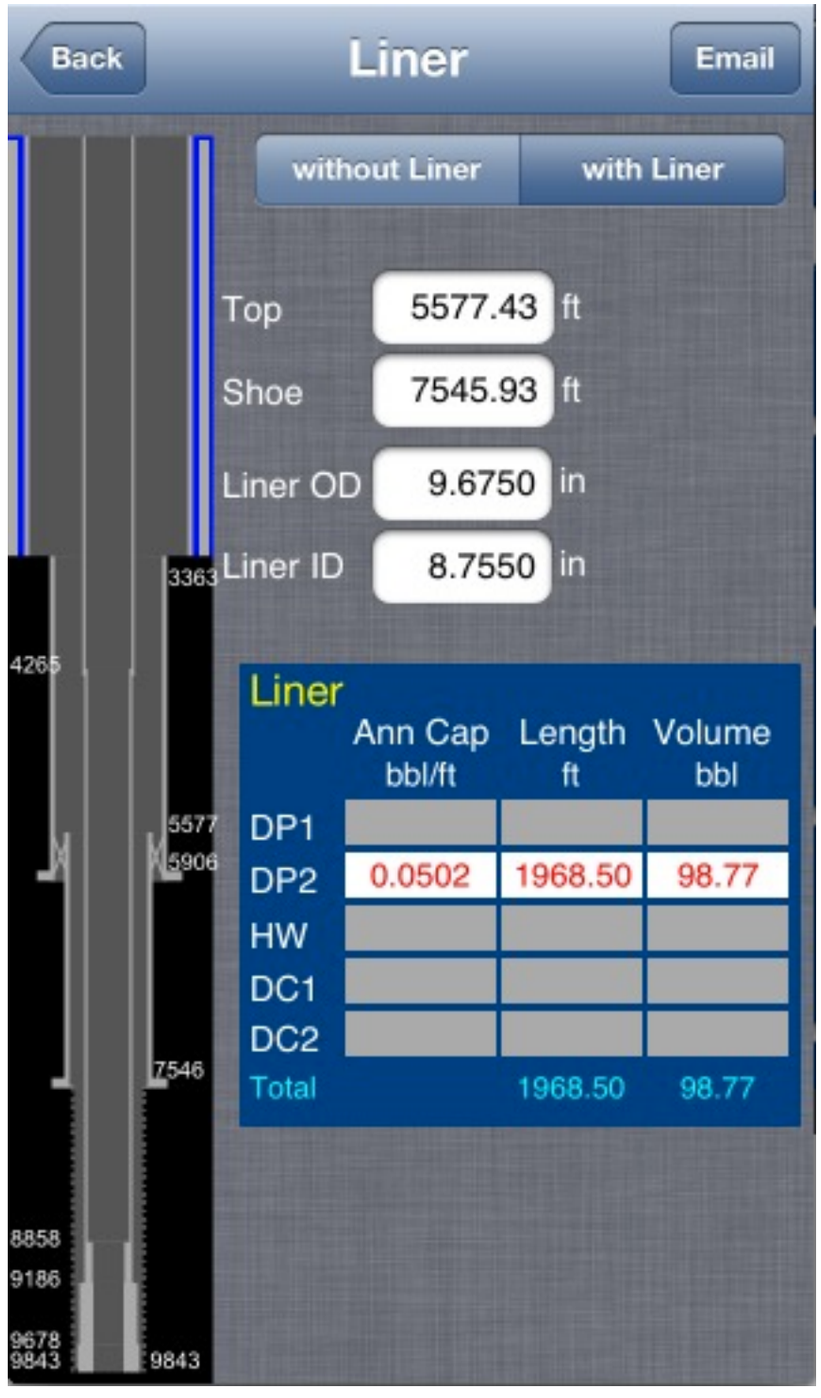
Well Configuration



Drill String

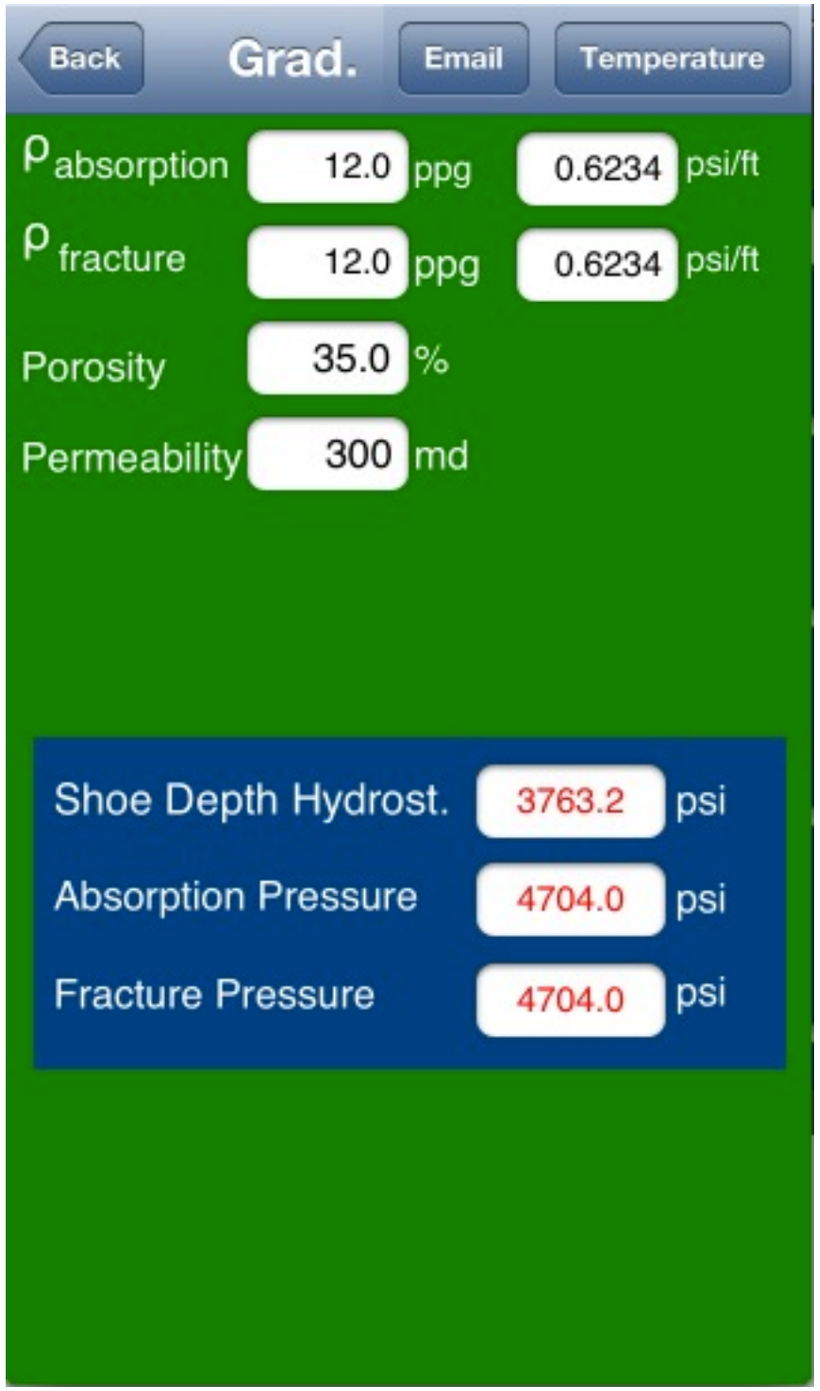


Liner

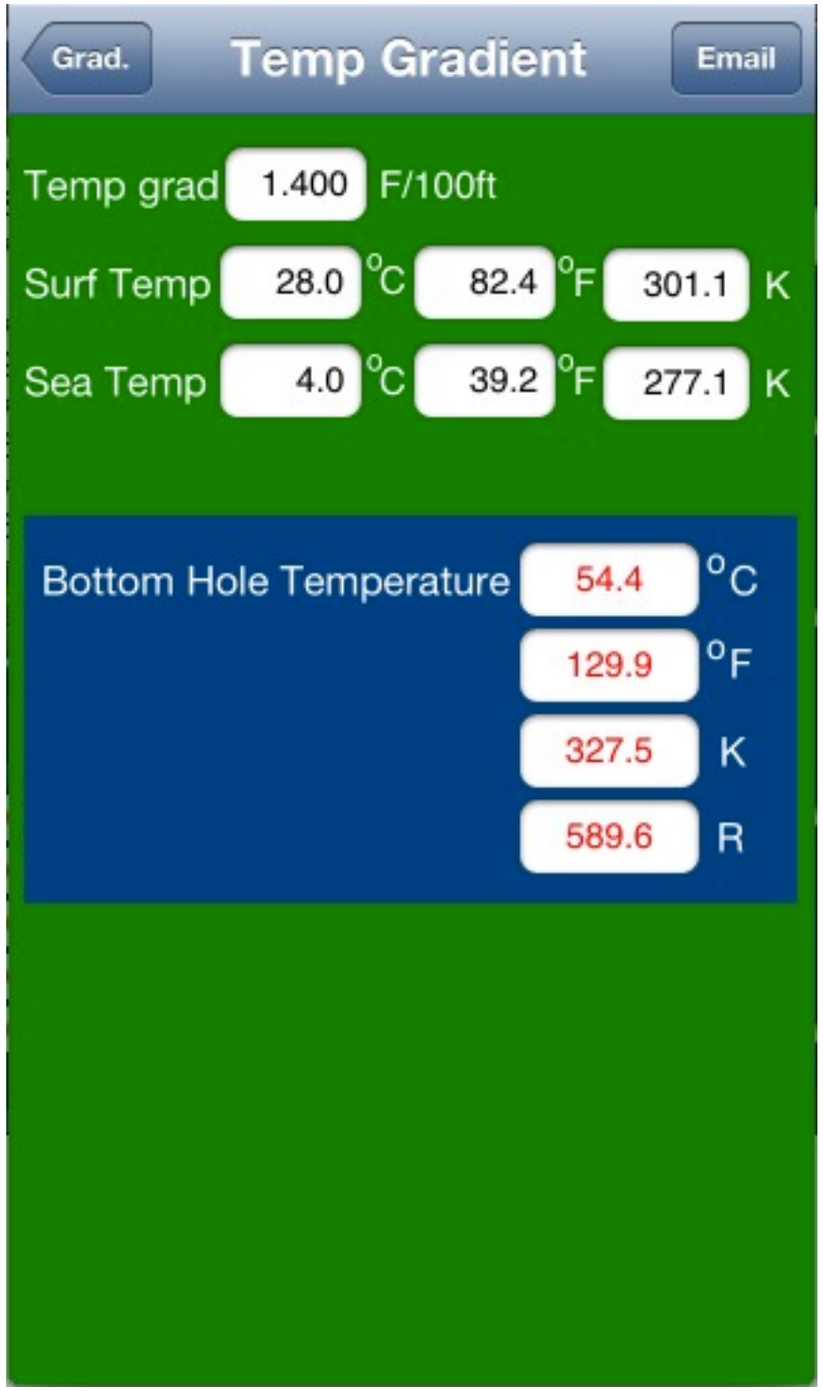


Note: screenshots with iPhone 5

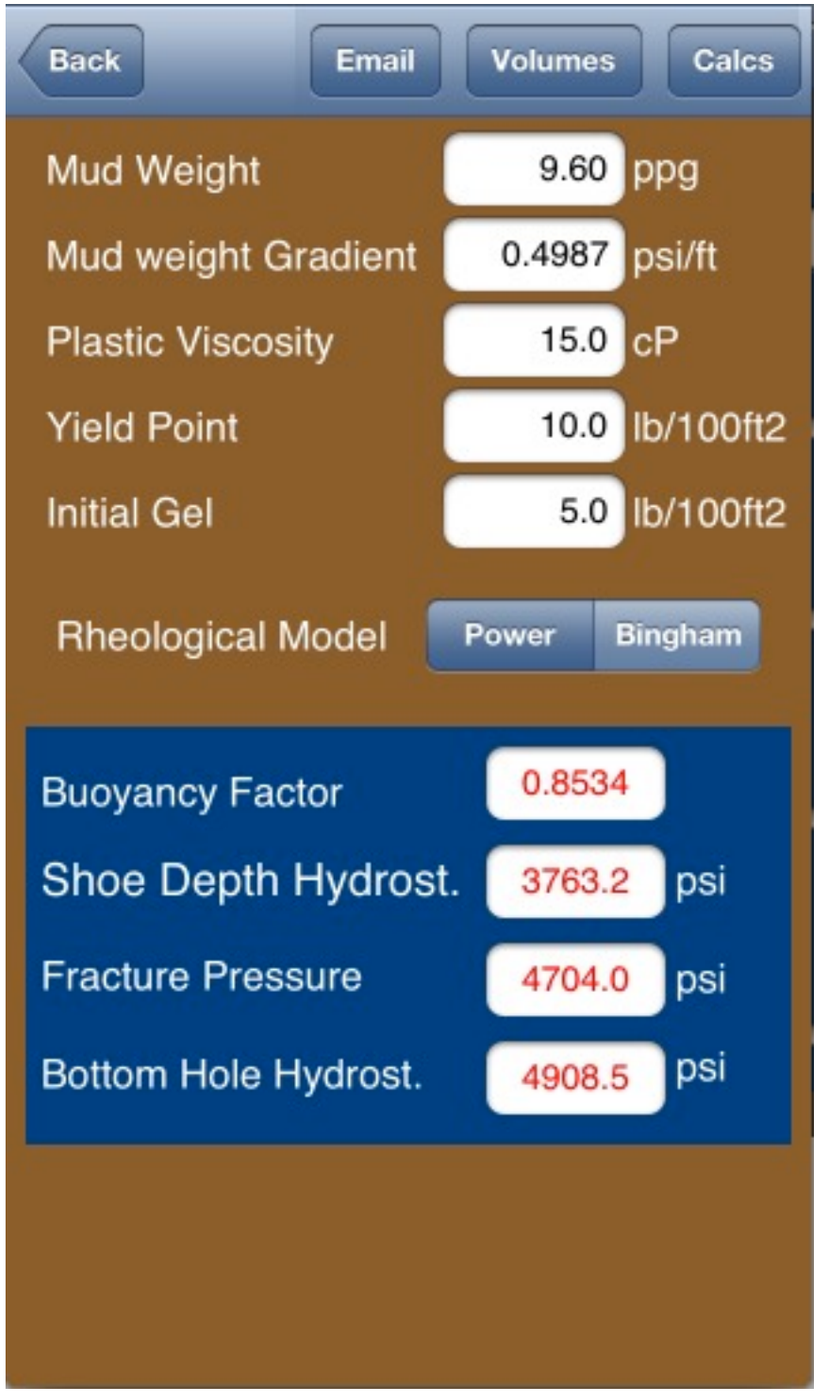
Gradients



Temperature Gradient

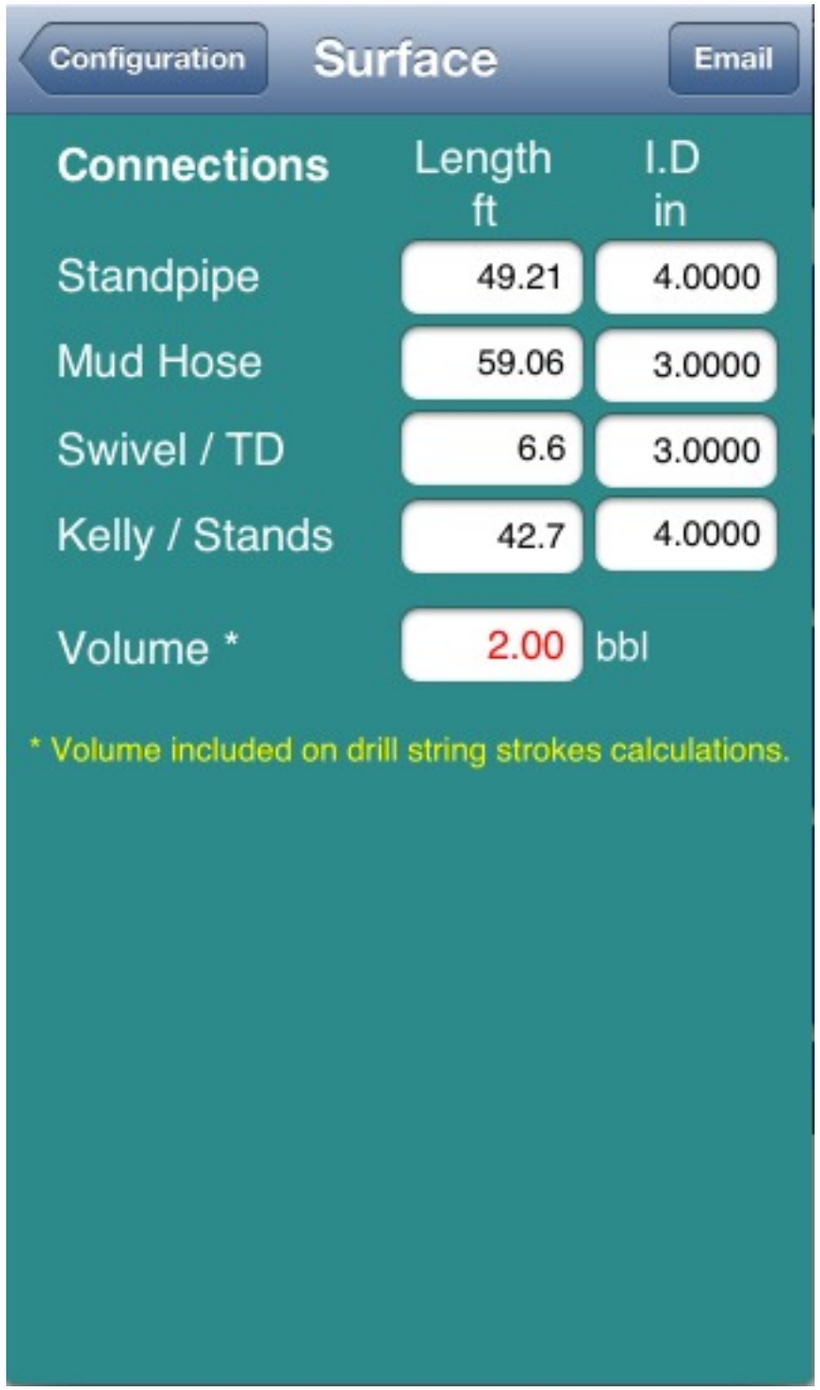


Mud

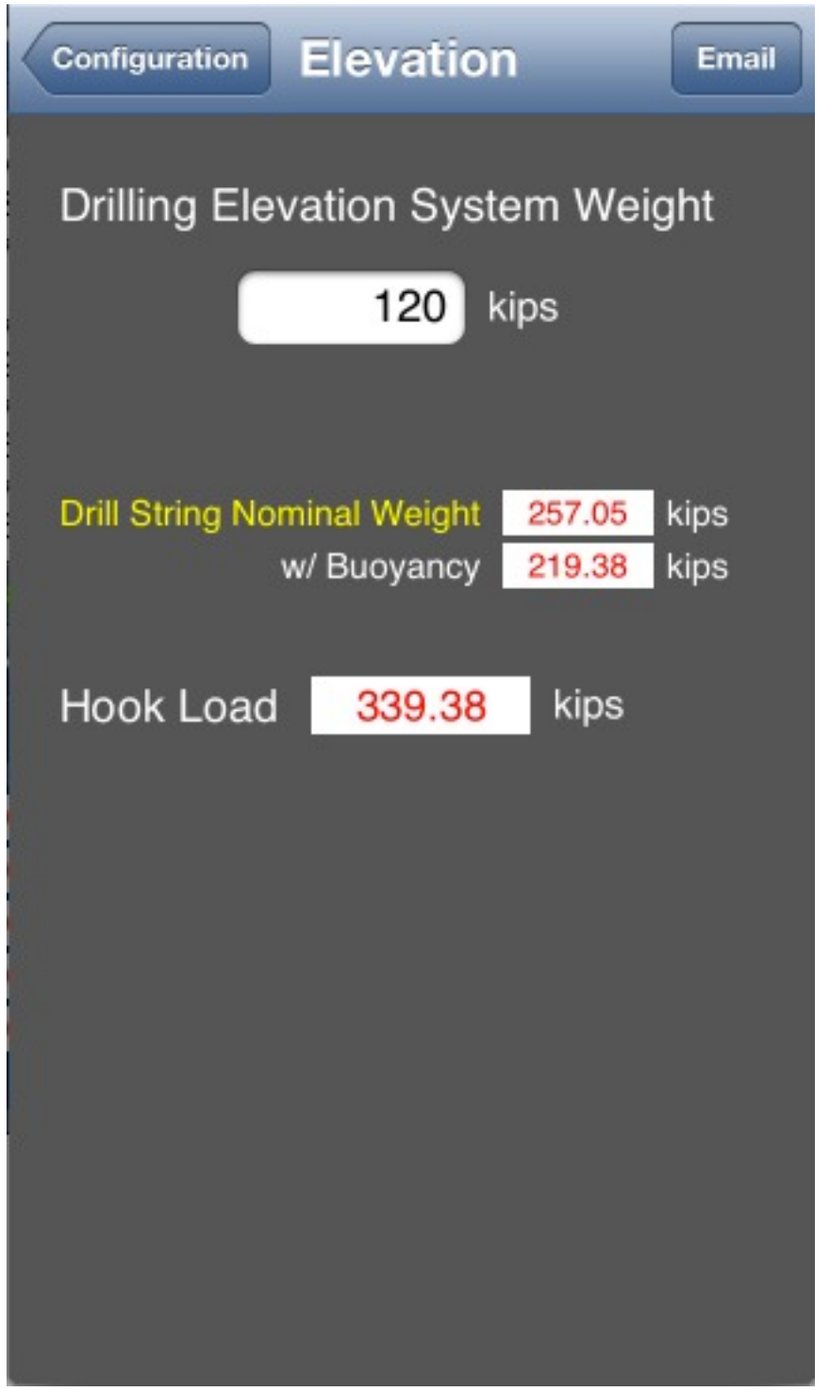


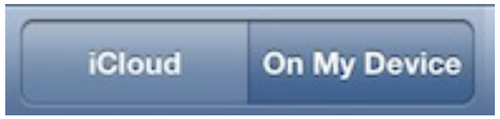
Mud Pumps

Surface Connections



Elevation System





When TAP on "**Open**" button, the data that is on the Data File Highlighted on Wheel is loaded in the RAM memory and can be saved with other file name.

Method to transfer data file between iCloud and Local:

The user can open a data file on **Local** (**On My Device**) and after save it on iCloud or the opposite.

iCloud Message:

On the first time that the user taps on "**Open**" button, the download of the data file is started from the iCloud to a local address with internal access only. When the download is completed, it's possible open the data file.

The user must tap again on the "**Open**" button for checking. When OK, the data file is loaded in RAM memory and shown on the well schematic.

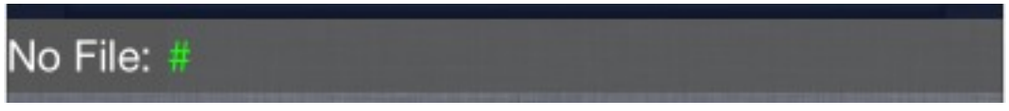
When TAP on "**Save**" button the data that are loaded in the RAM memory is saved to the data file named with the content of the File Name TextBox.

The data file is created in **iCloud** or **Local (On My Device)** according to the selected option.

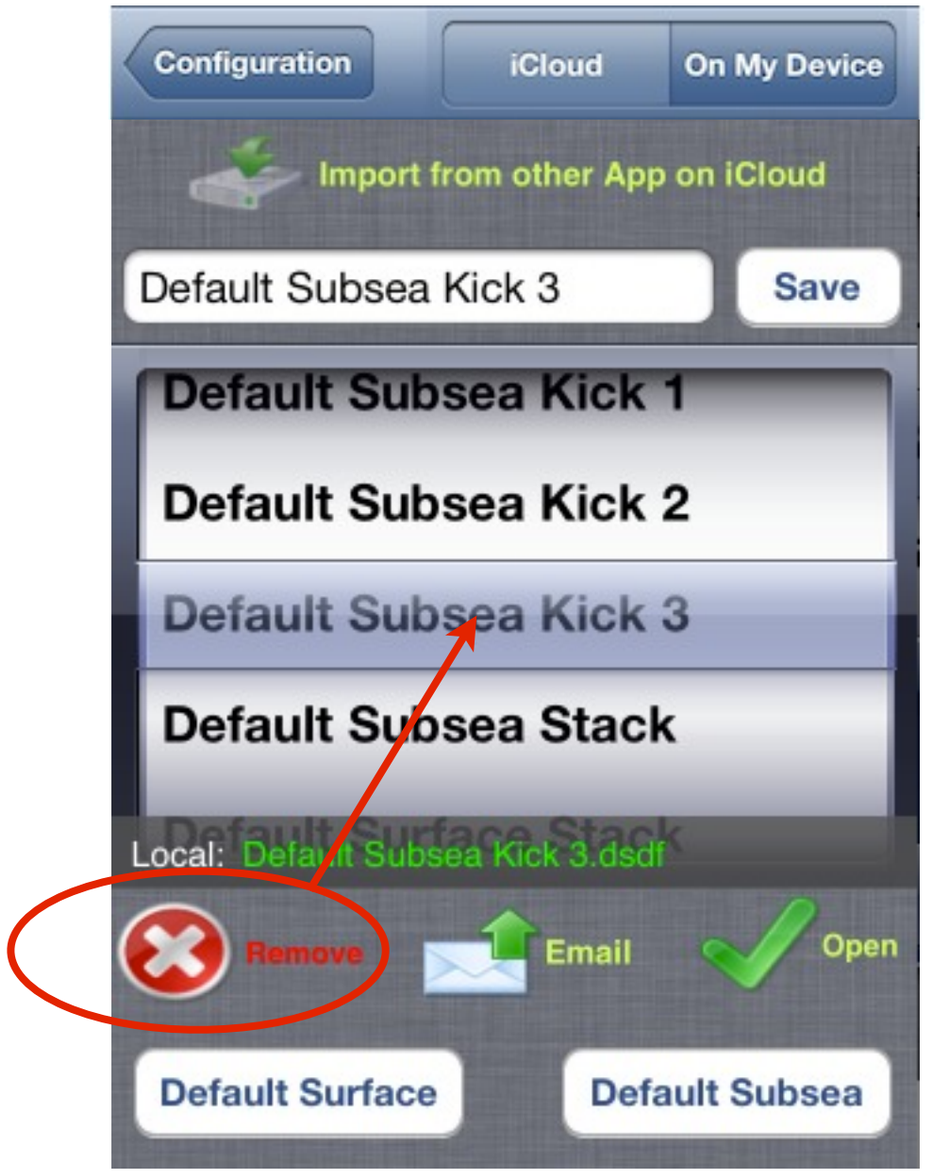
Recommendation

Save your exercise with different filenames at the points of interest for analyzes later.

When the status is "No File": "#", the data loaded not been saved but remain in ram memory.



Select the data file and Tap on "**Remove**" button.

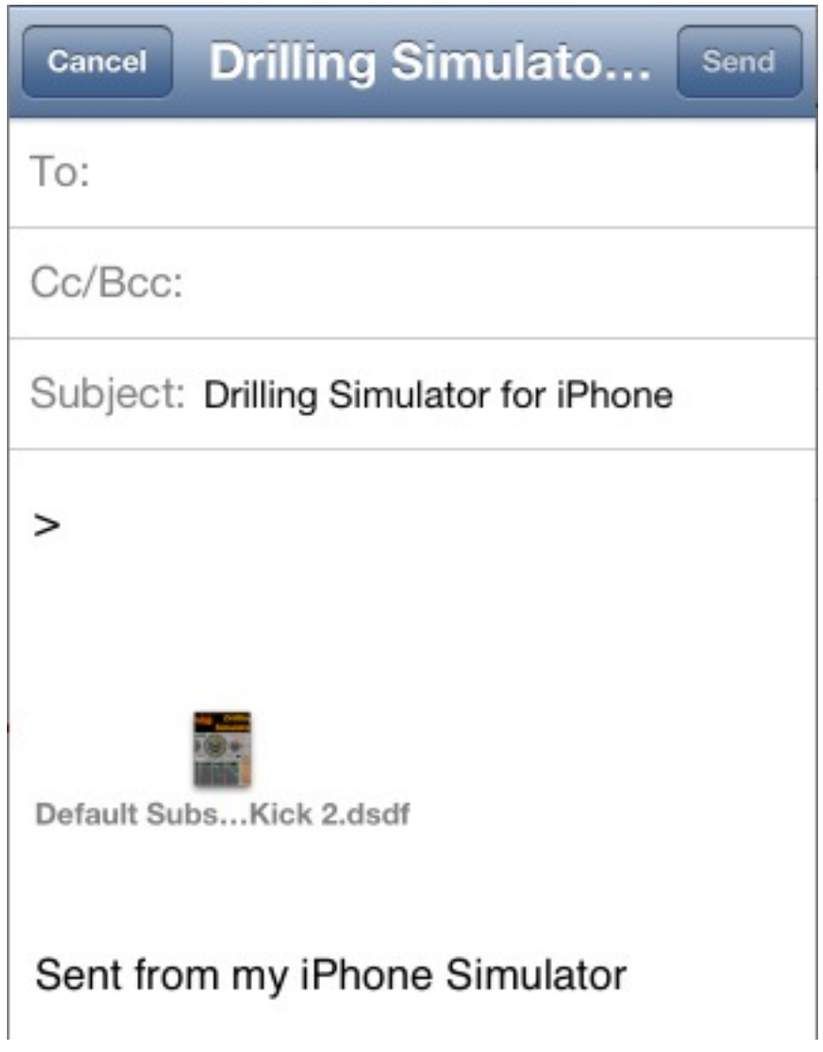


Tap on "**Yes**" button to confirm.

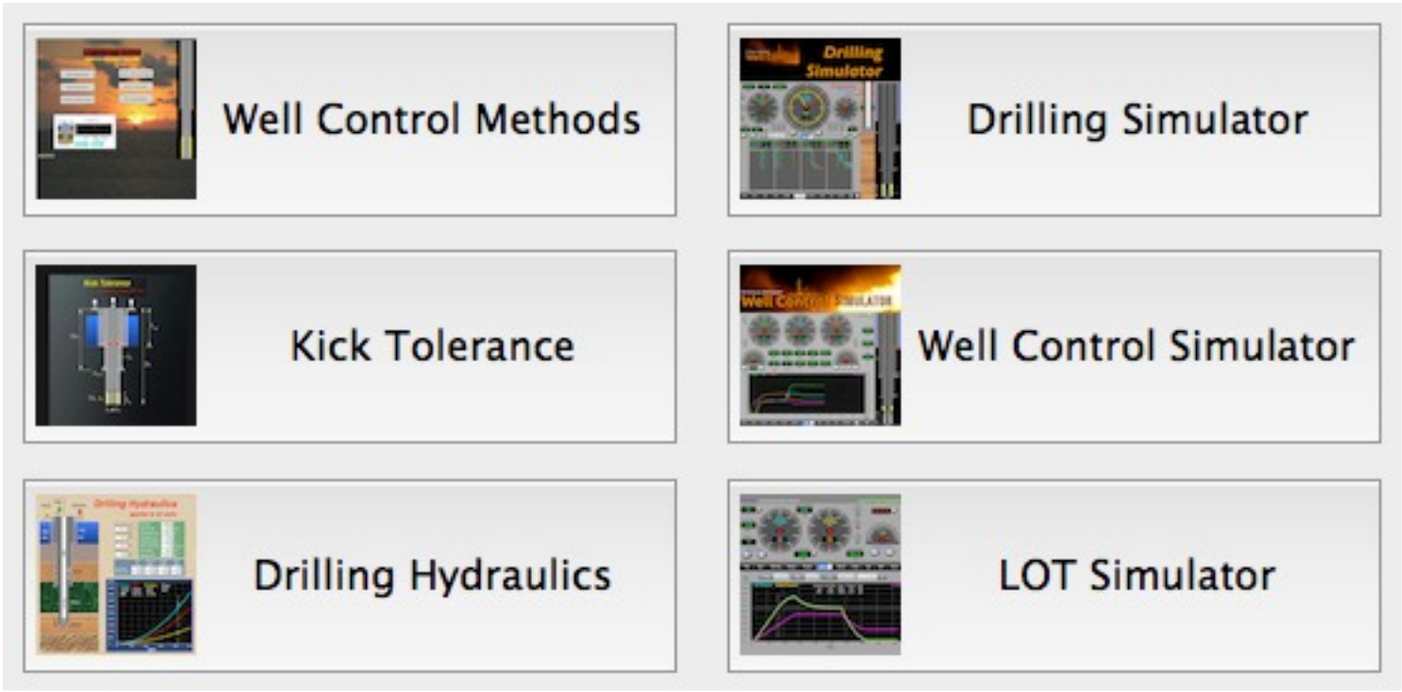
Attention:
When a data file is removed, the data is lost.

Select the data file and TAP on “**Email**” button.

In the email view, fill the fields of the email header and edit the email text if necessary. Tap on “**Send**” or “**Cancel**” button.



In this time, the follow apps can to share the same well data and also some operational parameters.

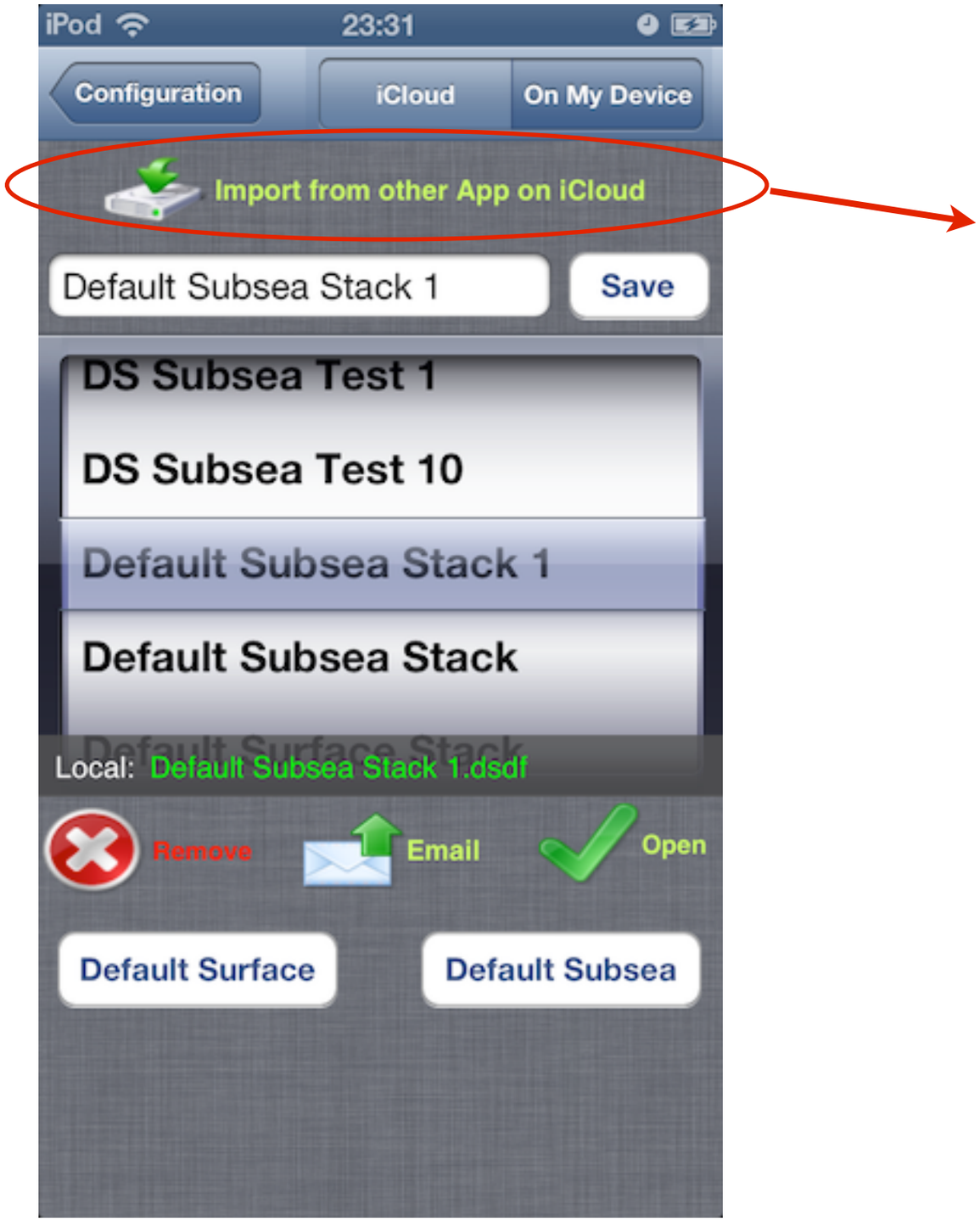


iPad and Mac only

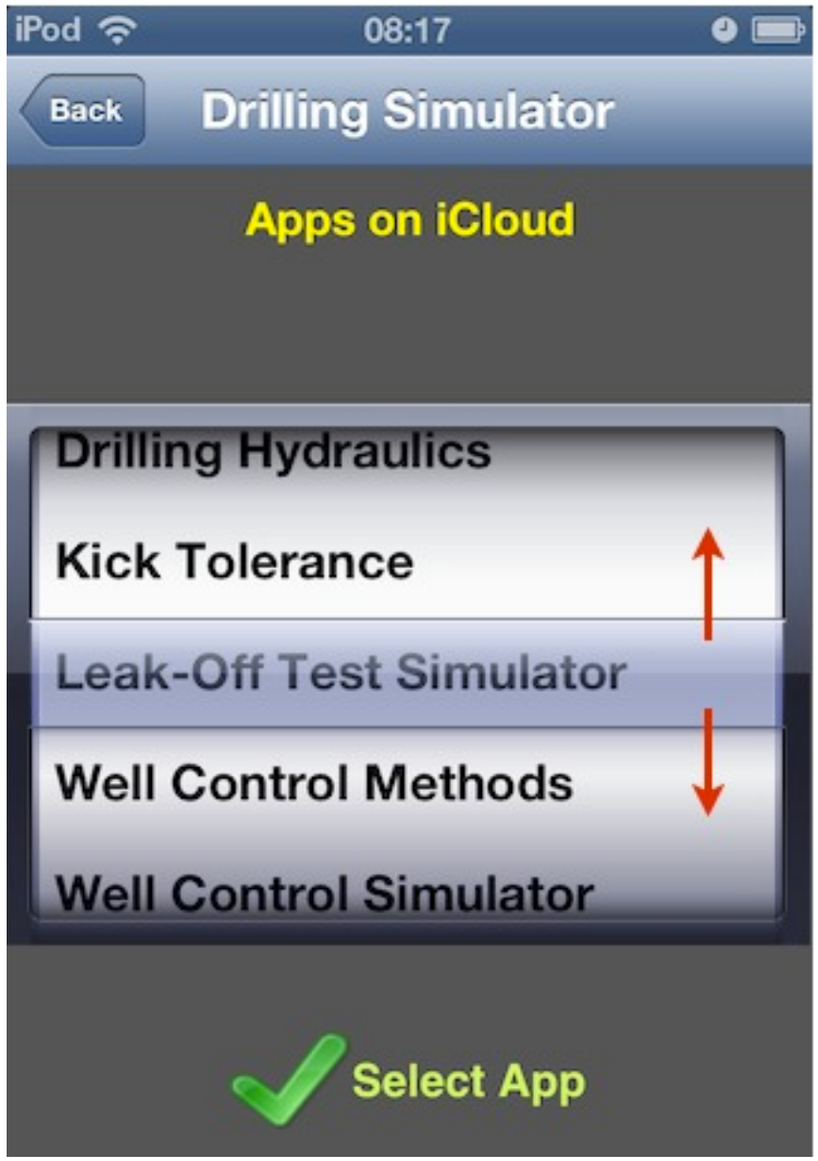
Notes:

- The well data is common for the 6 apps (Well Control Methods, Kick Tolerance, Drilling Hydraulics, Drilling Simulator, Well Control Simulator and Leak-Off Test Simulator).
- The Drilling Simulator and Well Control Simulator have the same parameters. They have some exclusive parameters (drill string pipe weight, etc).
- The Drilling Hydraulics has exclusively the parameters: mup pumps #3 and #4 and drilling motor.
- The Well Control Worksheets only import data from other apps to fill the kill sheets.

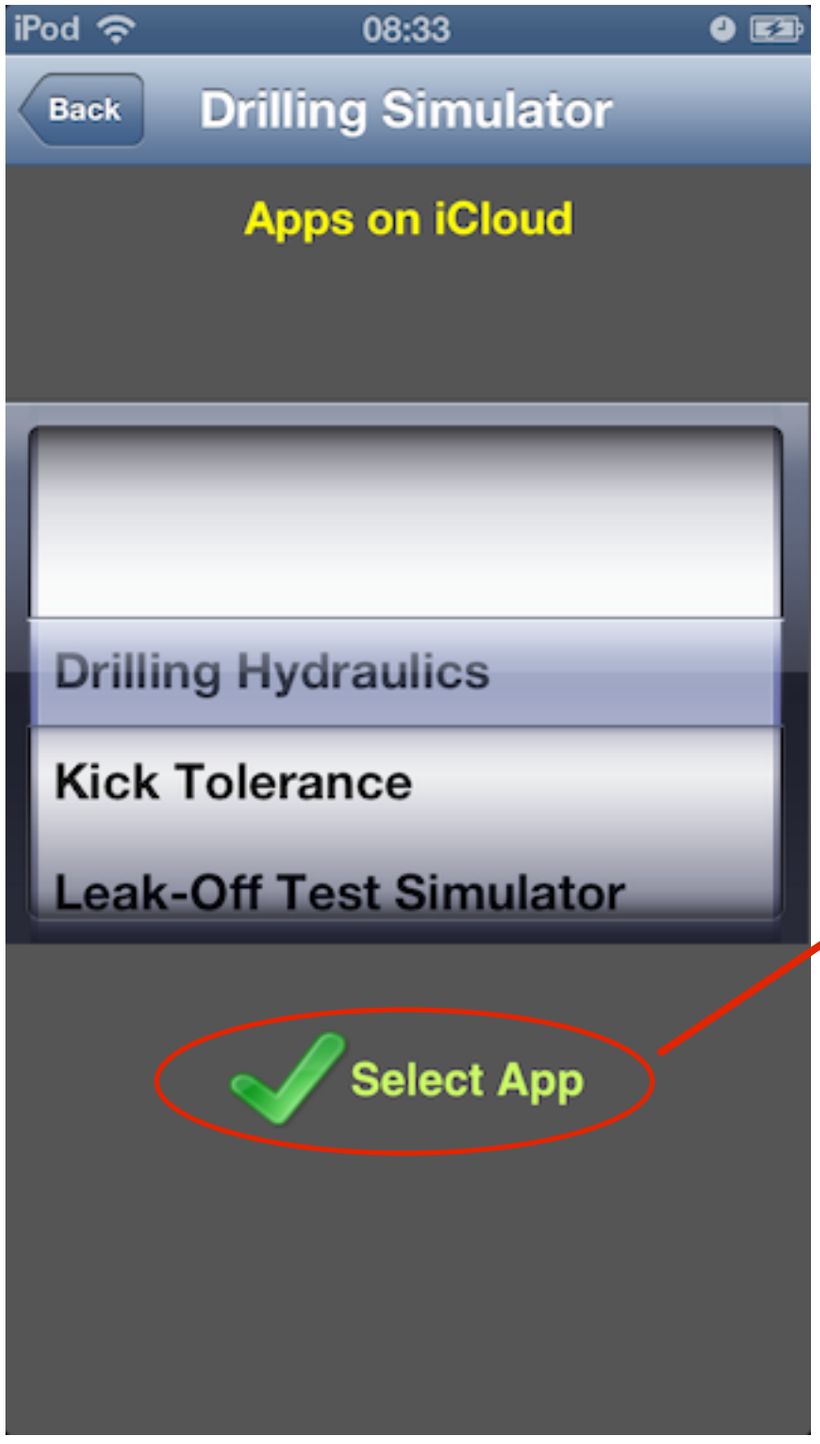
In this example, we will import data from **Drilling Hydraulics** App. Tap on "**Import from Other Apps on iCloud**" button.



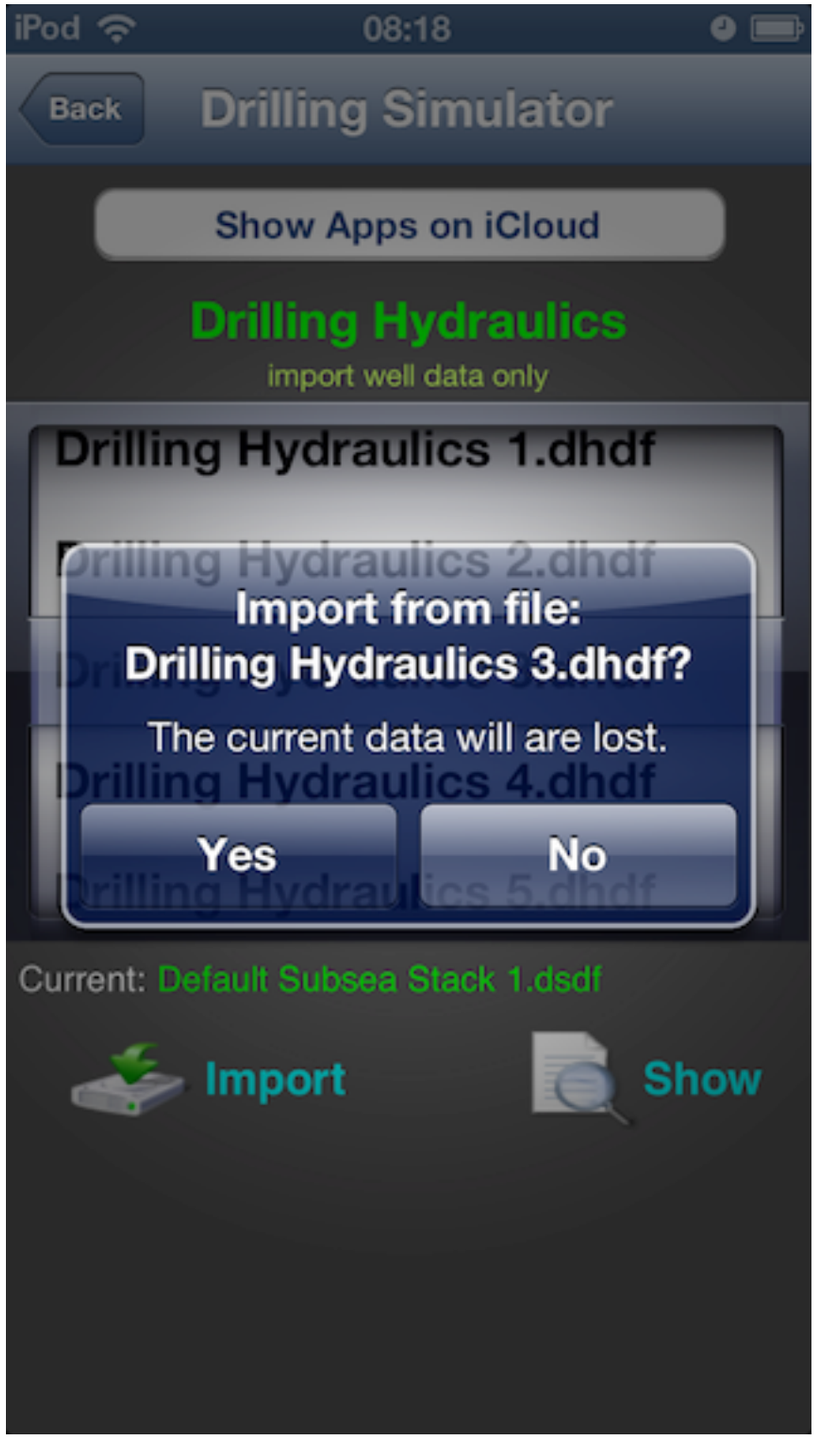
The apps on the User iCloud are listed on the data wheel. Select the App to list the data files.

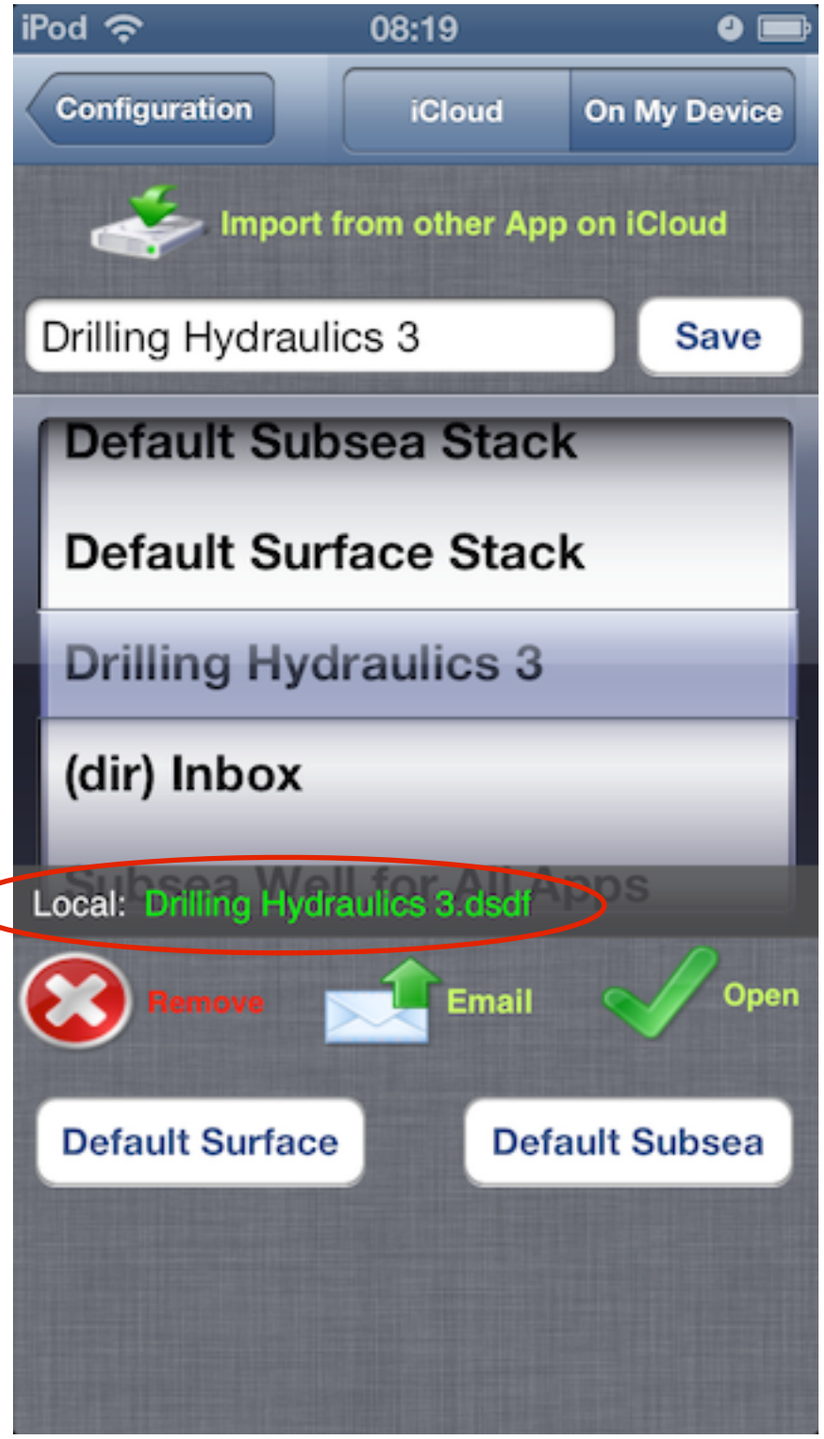


Select the App to list the data files. Move the wheel up/down to select the data file and Tap on “**Import**” button.

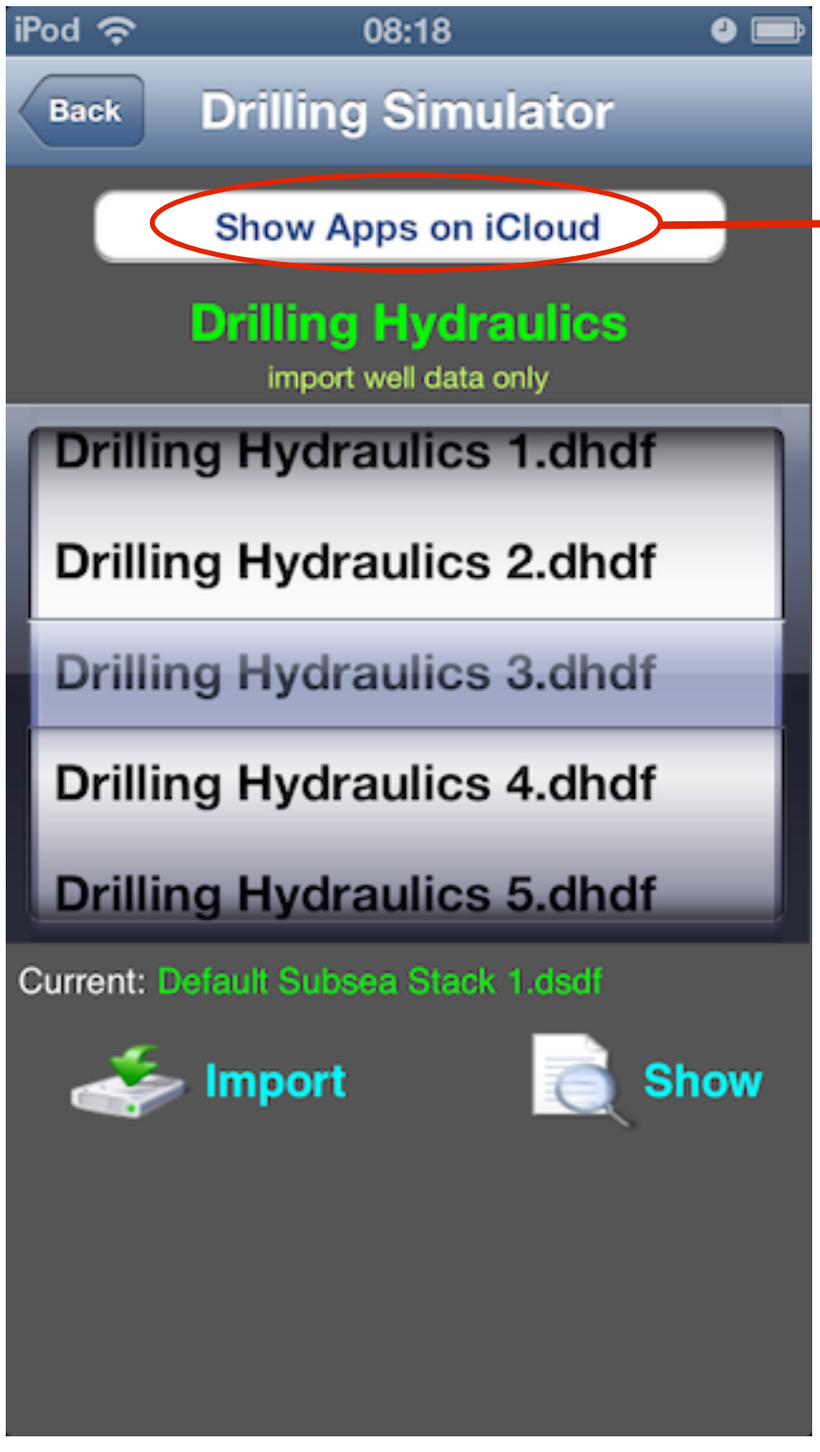


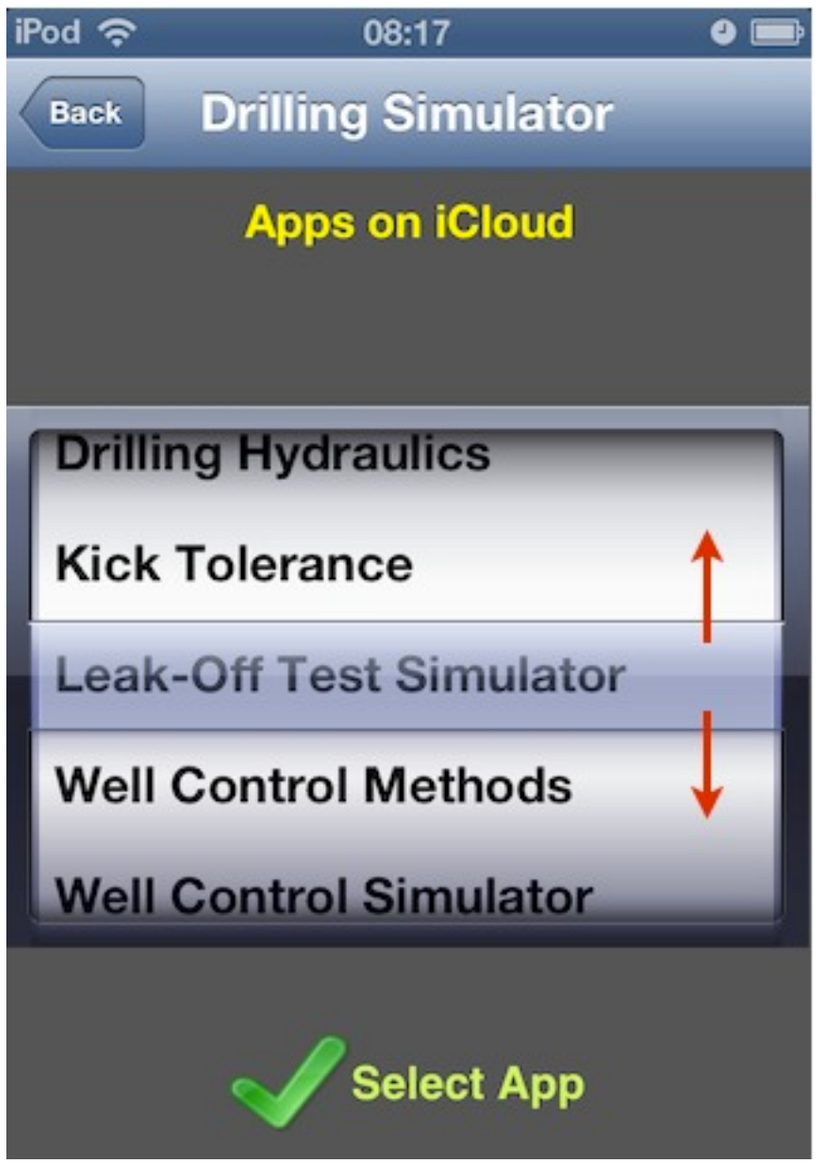
After to import, the data file is saved with the same filename (*.dsdf) on **iCloud** or **On My Device** according to the selected option.



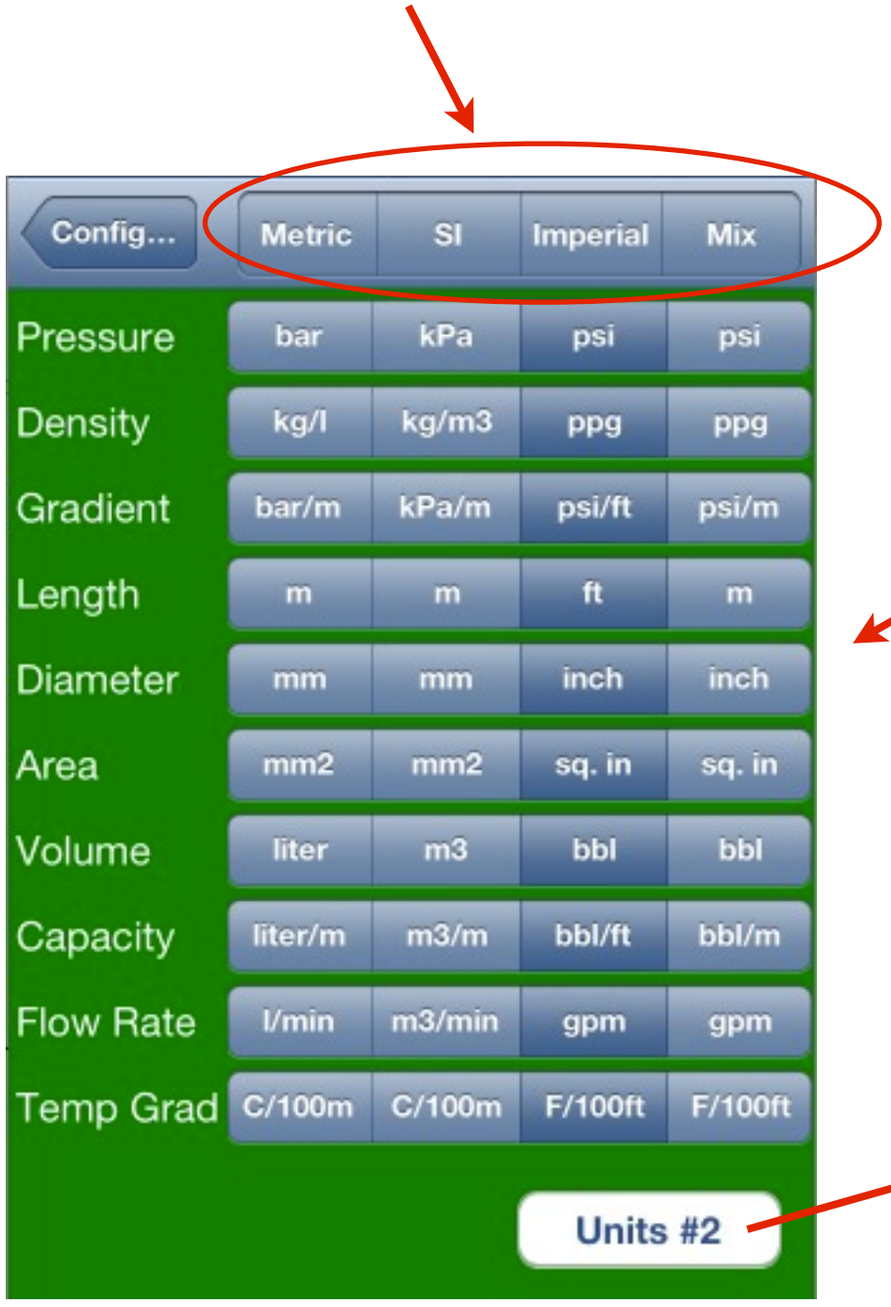


Tap on “**Show Apps on iCloud**” to select other app or Tap on “**Import from Other Apps on iCloud**” button to close the popup view





Select the ‘Unit System’ option:



Or select the unit for each parameter

On **Main View**, tap on "**Well**" button on toolbar to edit the Well Configuration.

Well Configuration Interface

Well Types: Vertical x Directional

Well with Liner

Stack Types: Surface x Subsea

Drill String

Capacities & Volumes

Drill Bit

Gradients

Drilling Fluid (Mud)

Mud Volume

Surface Circulation Volume

Formations to Drill

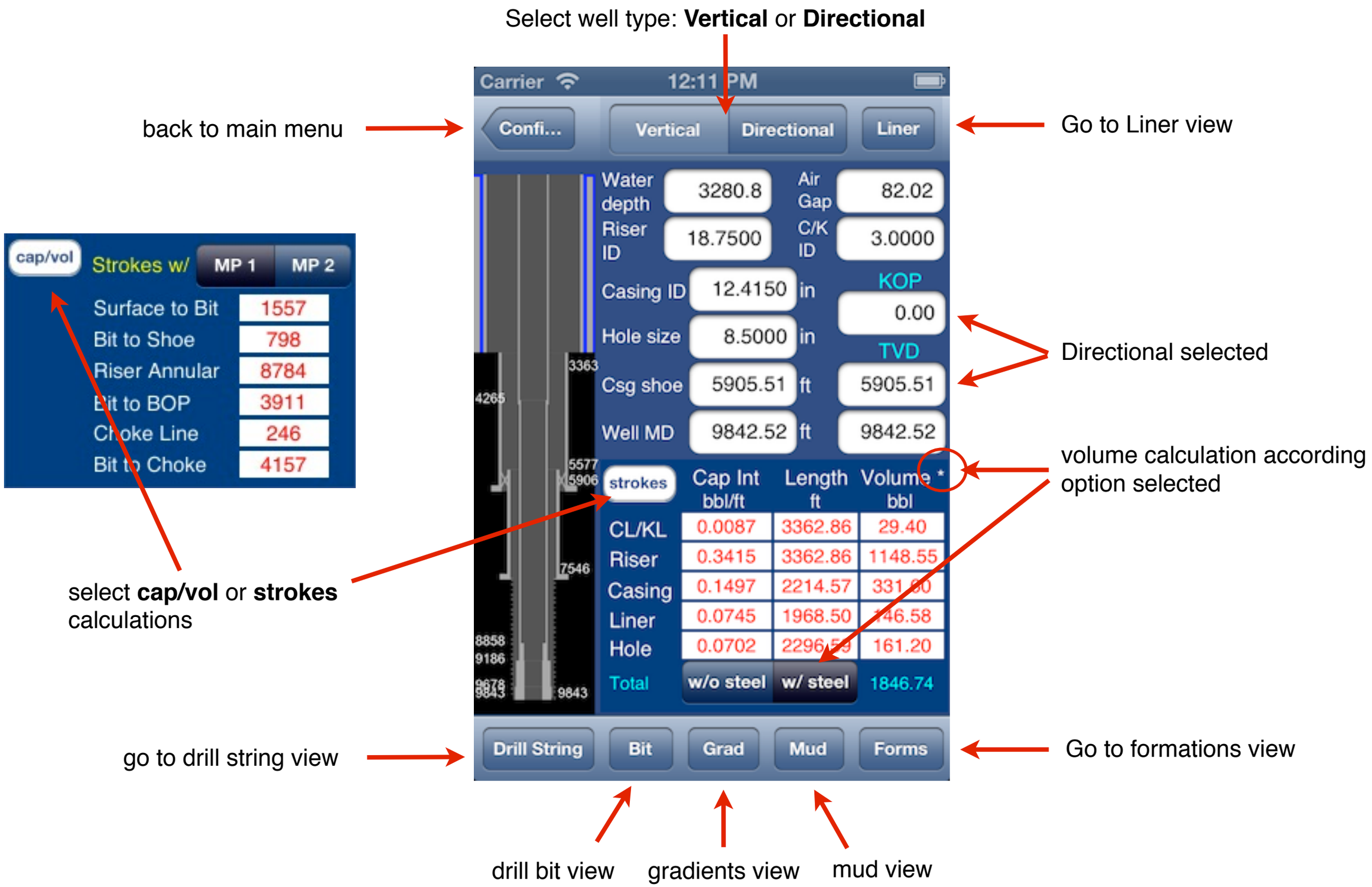
Mud Pumps

Surface Connections

Elevation System

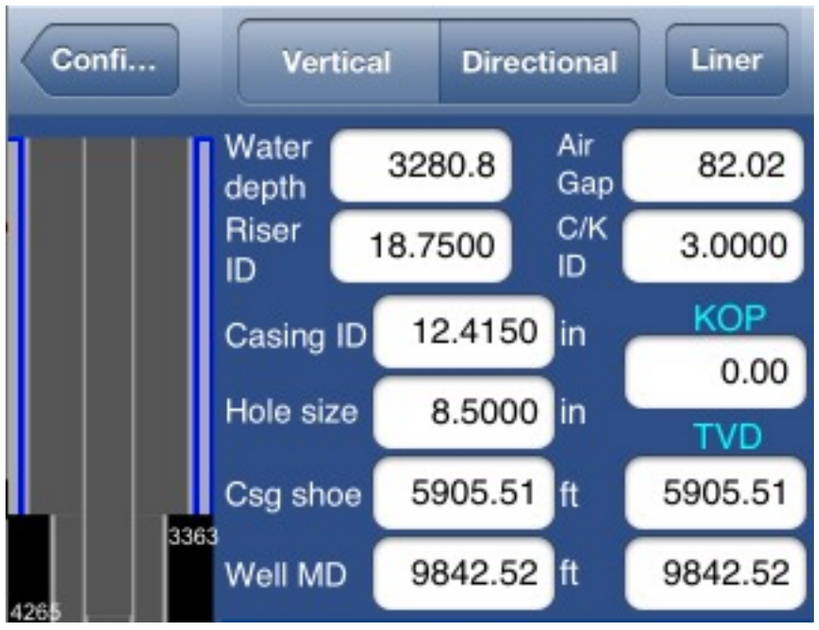
Hydraulics Choke and BOP

On **Main View**, tap on "**Well Configuration**" option to edit the Well Configuration.



Vertical Well

Directional Well



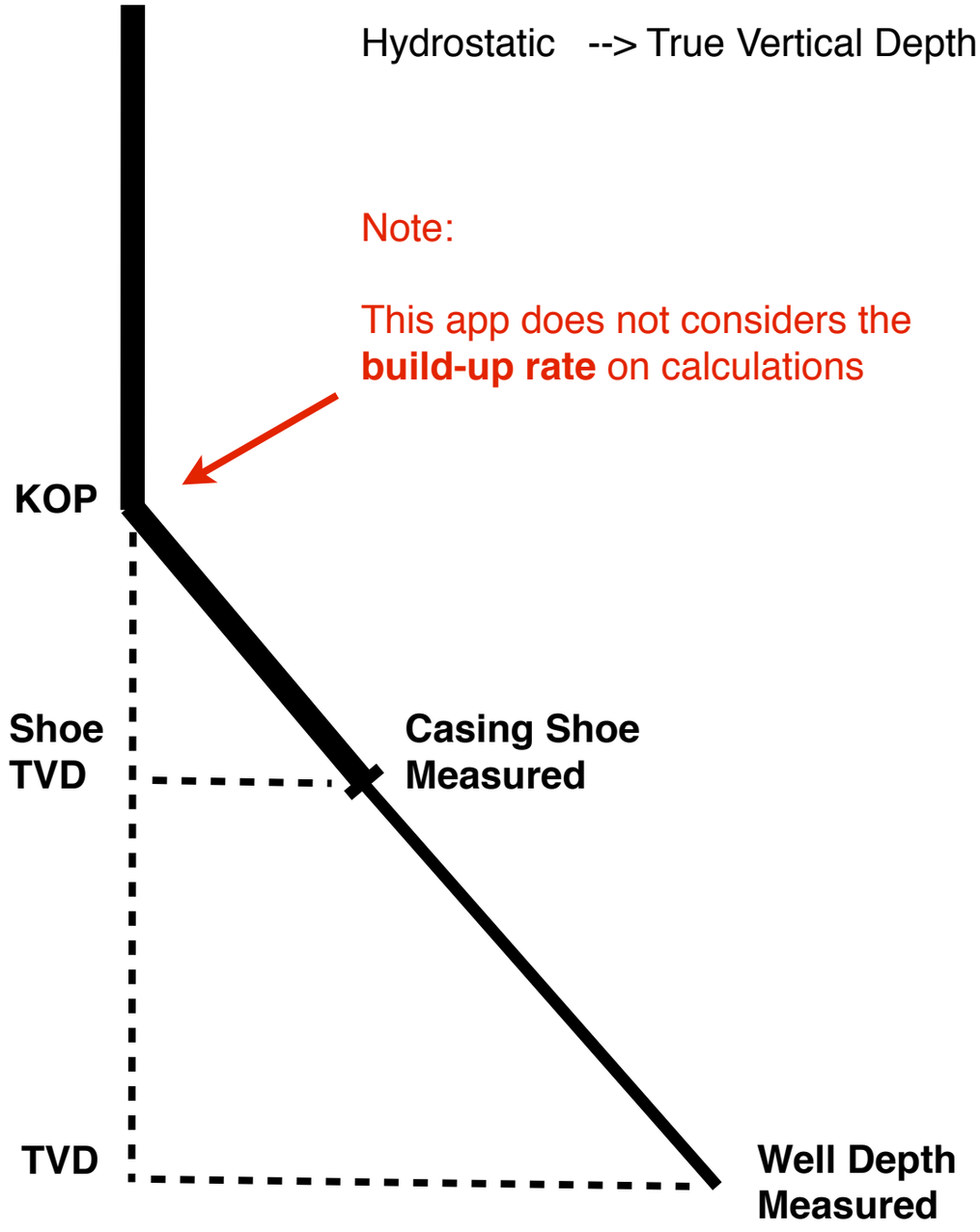
Calculations:

Friction Loss --> Measured Depth

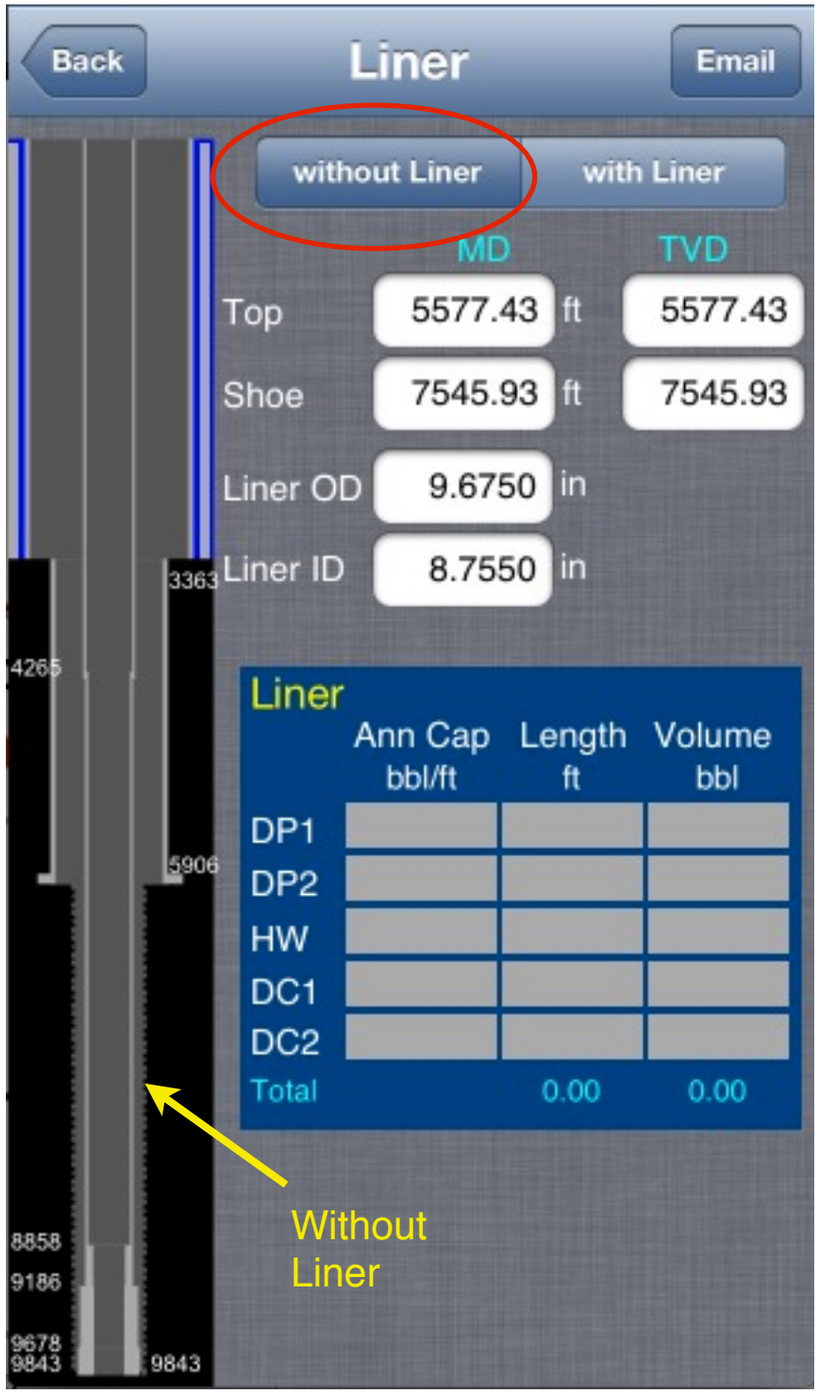
Hydrostatic --> True Vertical Depth

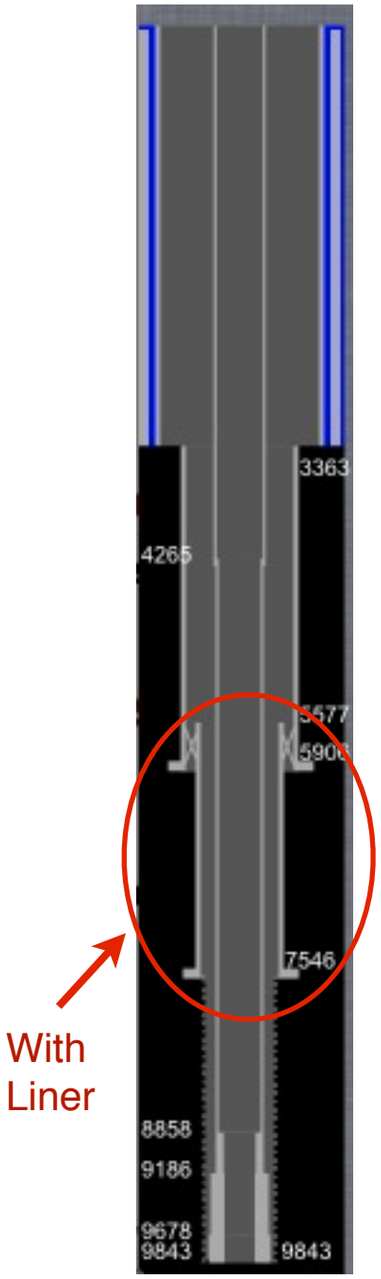
Note:

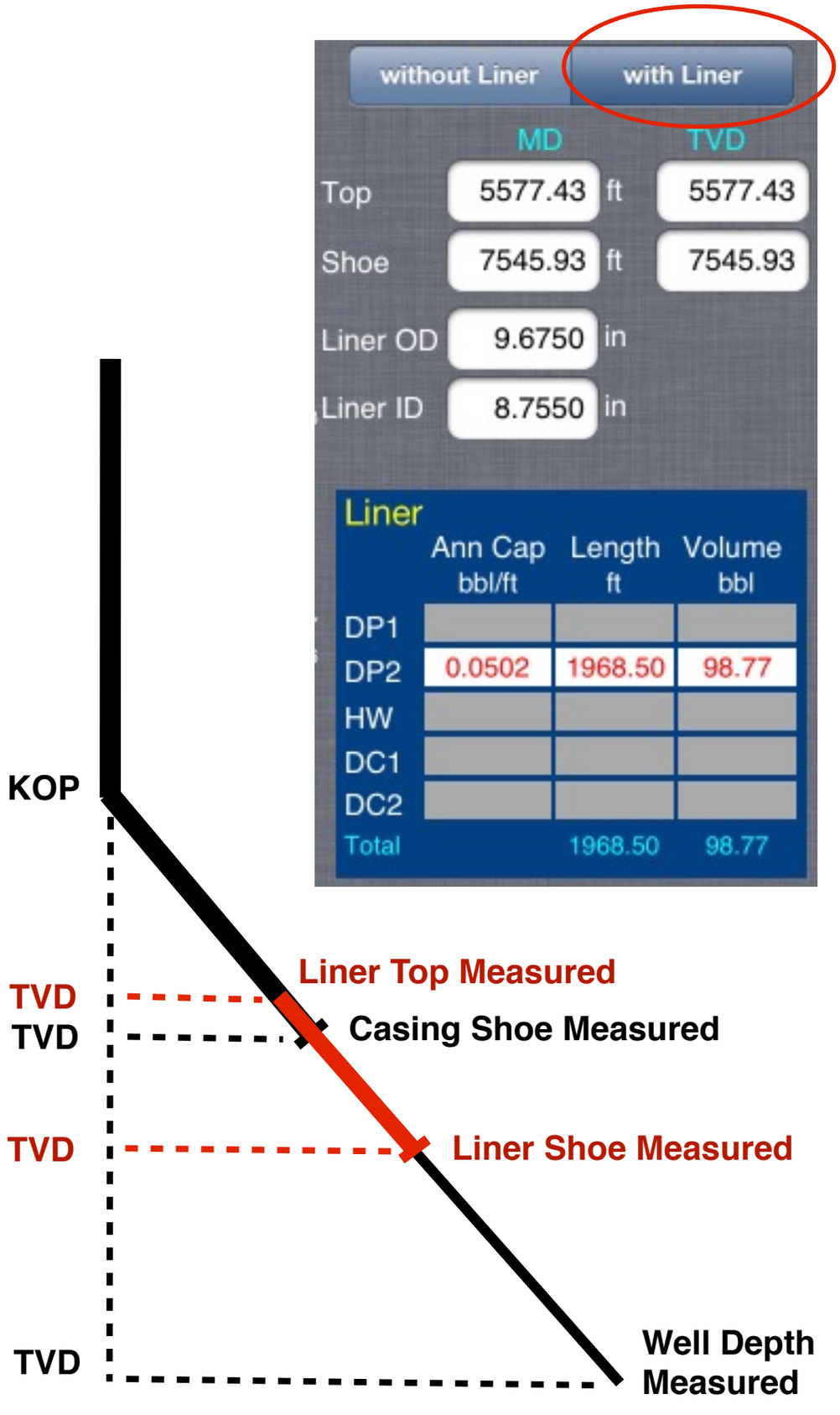
This app does not considers the **build-up rate** on calculations

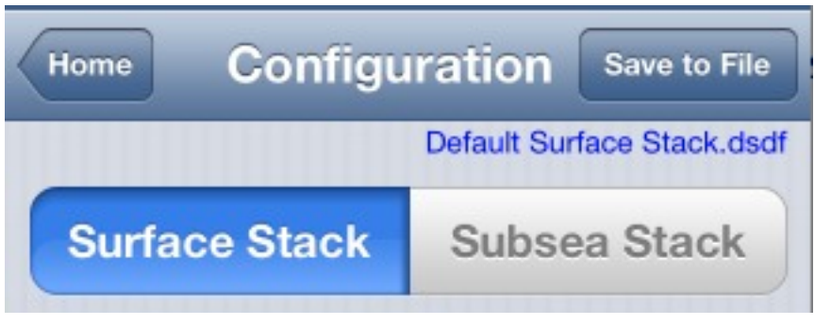


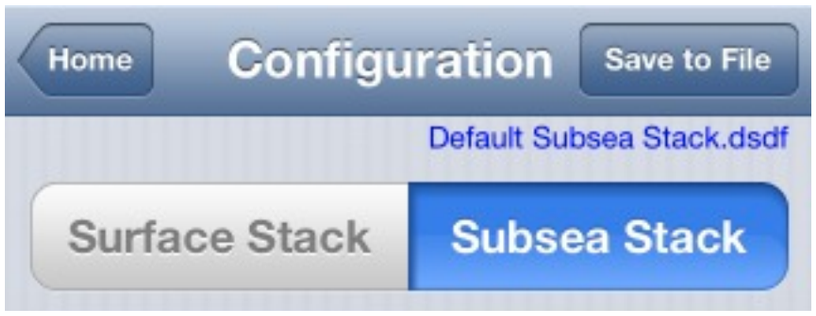
Tap “**Liner**” button on navigation bar to edit the liner parameters

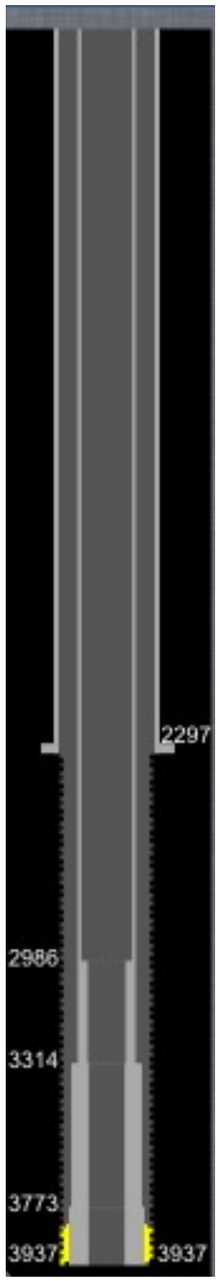


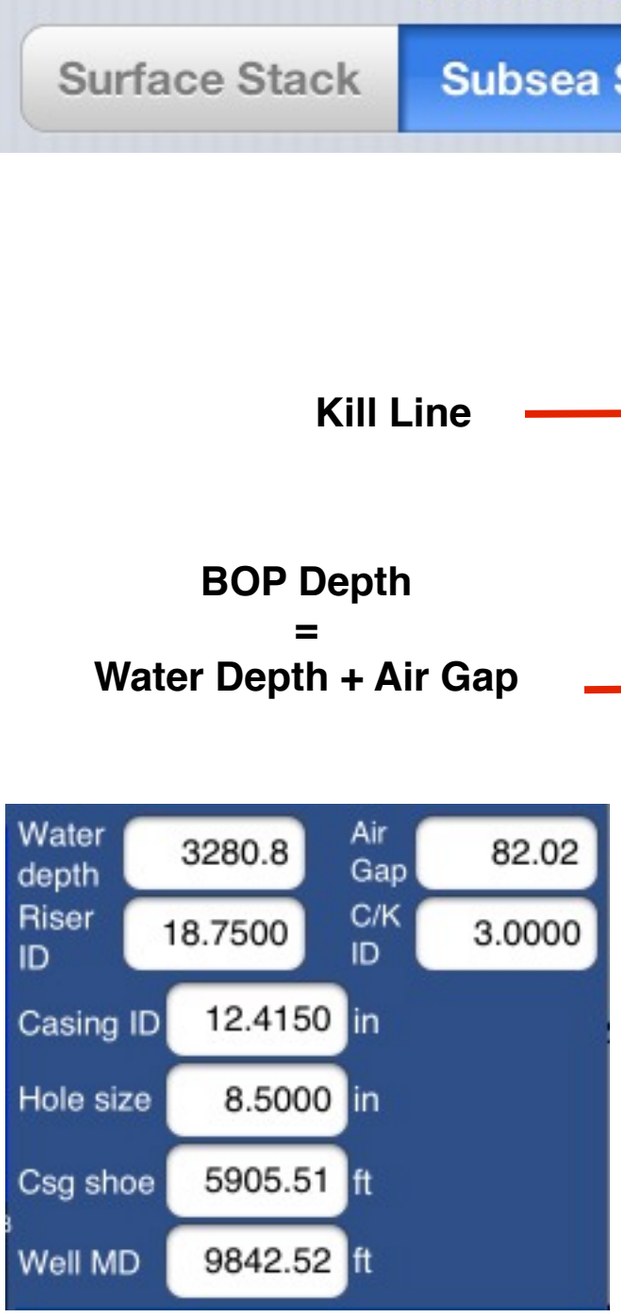


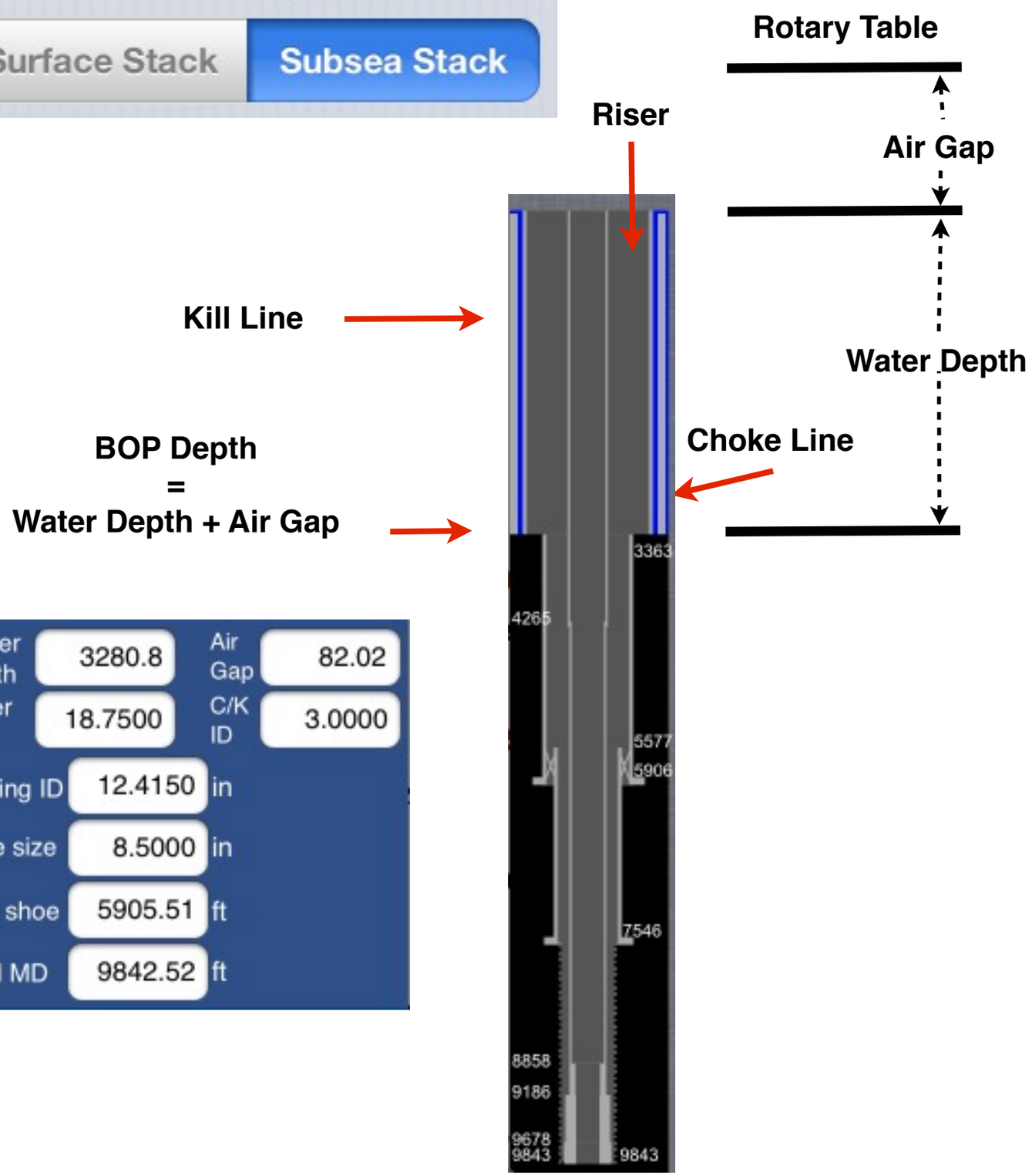


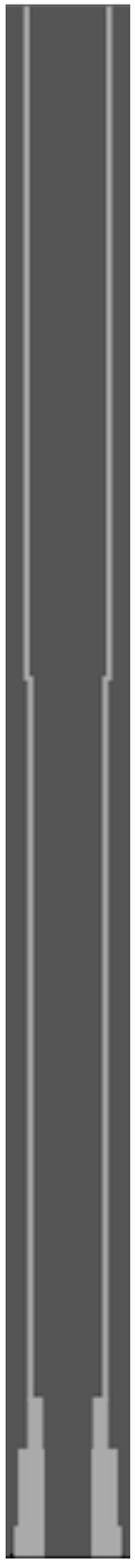

Home
Configuration
Save to File
Default Surface Stack.dsdf
Surface Stack
Subsea Stack


Home
Configuration
Save to File
Default Subsea Stack.dsdf
Surface Stack
Subsea Stack


2297
2986
3314
3773
3937
3937


Water depth
3280.8
Air Gap
82.02
Riser ID
18.7500
C/K ID
3.0000
Casing ID
12.4150
in
Hole size
8.5000
in
Csg shoe
5905.51
ft
Well MD
9842.52
ft


Rotary Table
Riser
Air Gap
Kill Line
Water Depth
BOP Depth
=
Water Depth + Air Gap
Choke Line
3363
4265
5577
5906
7546
8858
9186
9678
9843
9843



DP1

DP2

HW

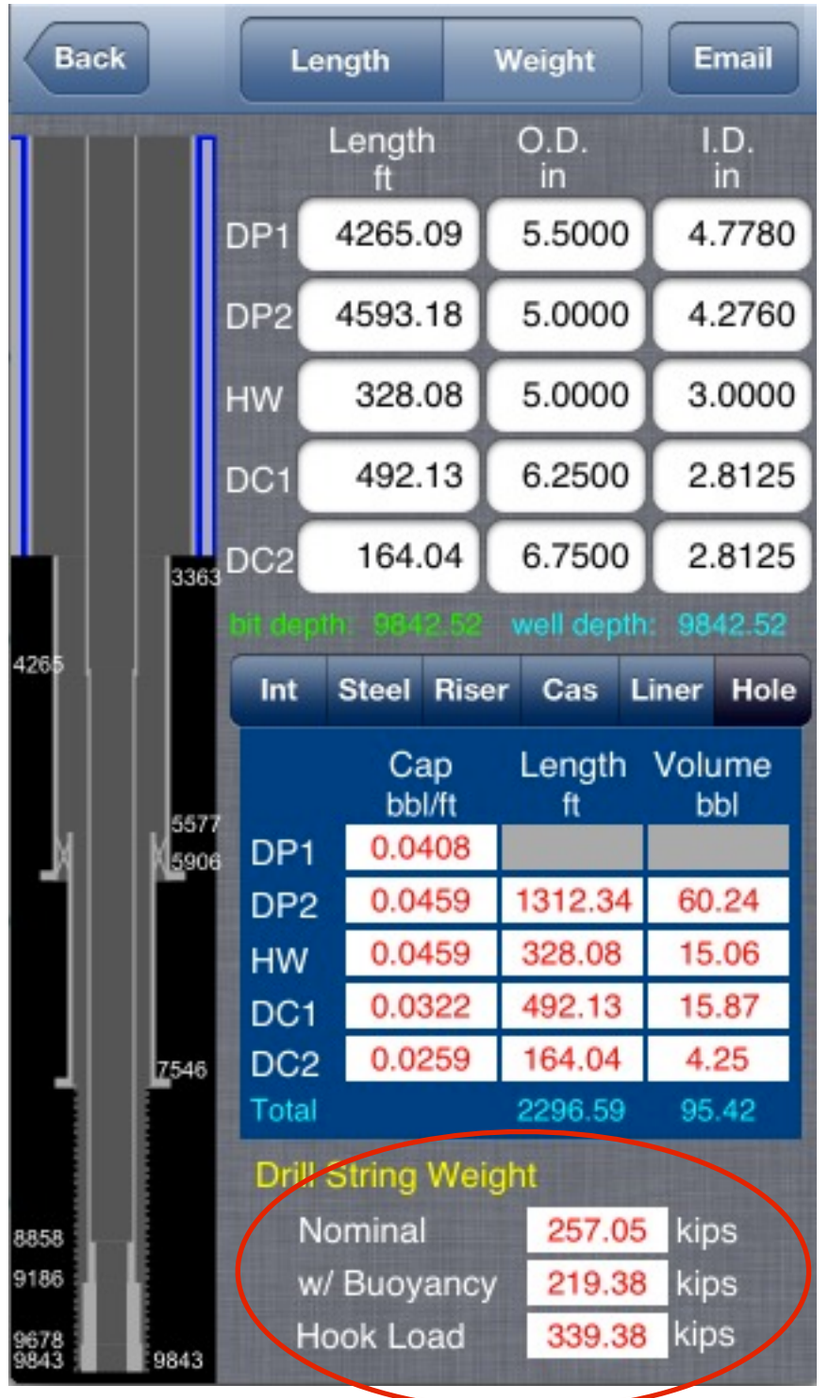
DC1

DC2

The drill string can be configured with:

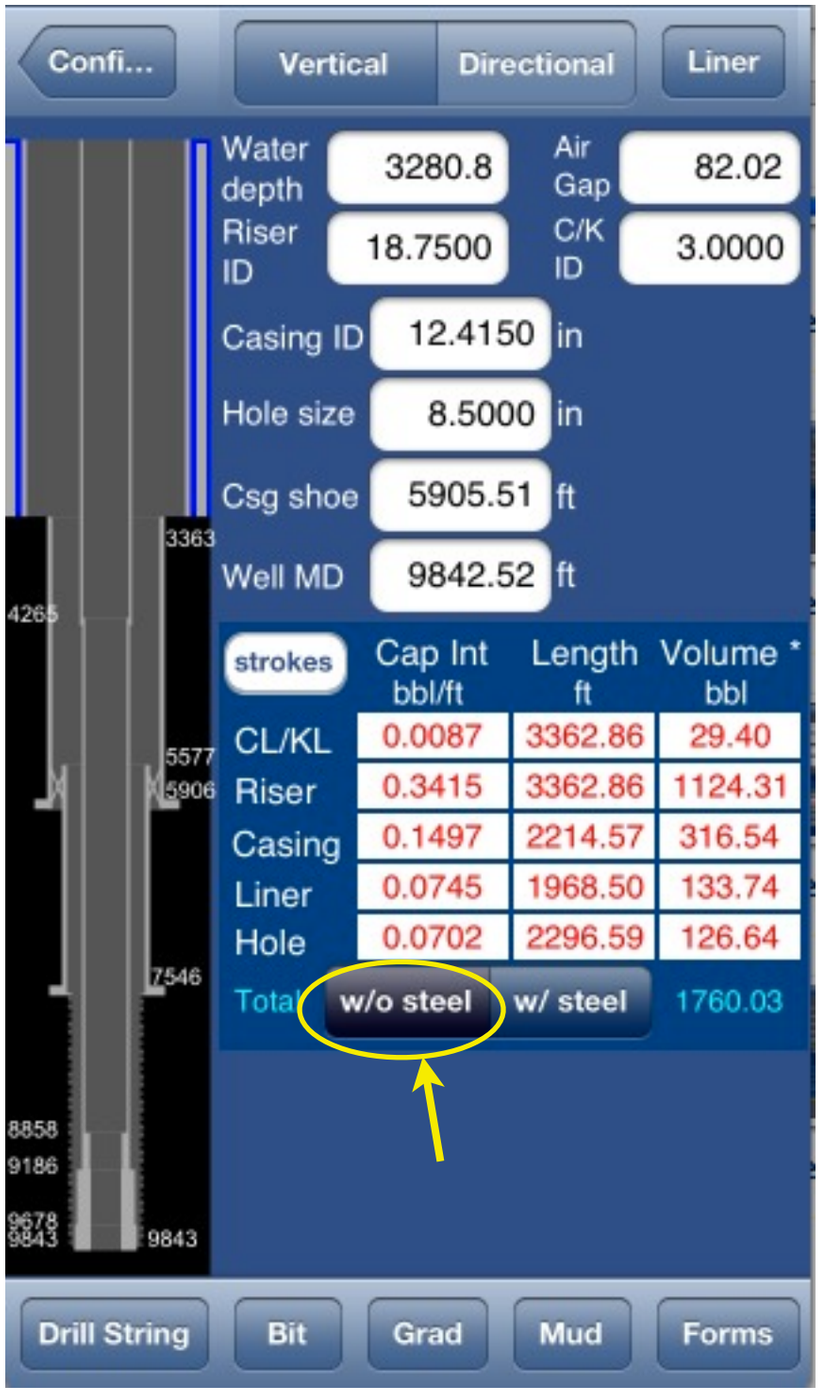
2 types of drill pipes (DP1 and DP2)
1 heavy weight drill pipe (HW)
2 drill collars (DC1 and DC2)

Note:
The Pipe Nominal Weight Parameter just can be edited with iPhone on vertical Position

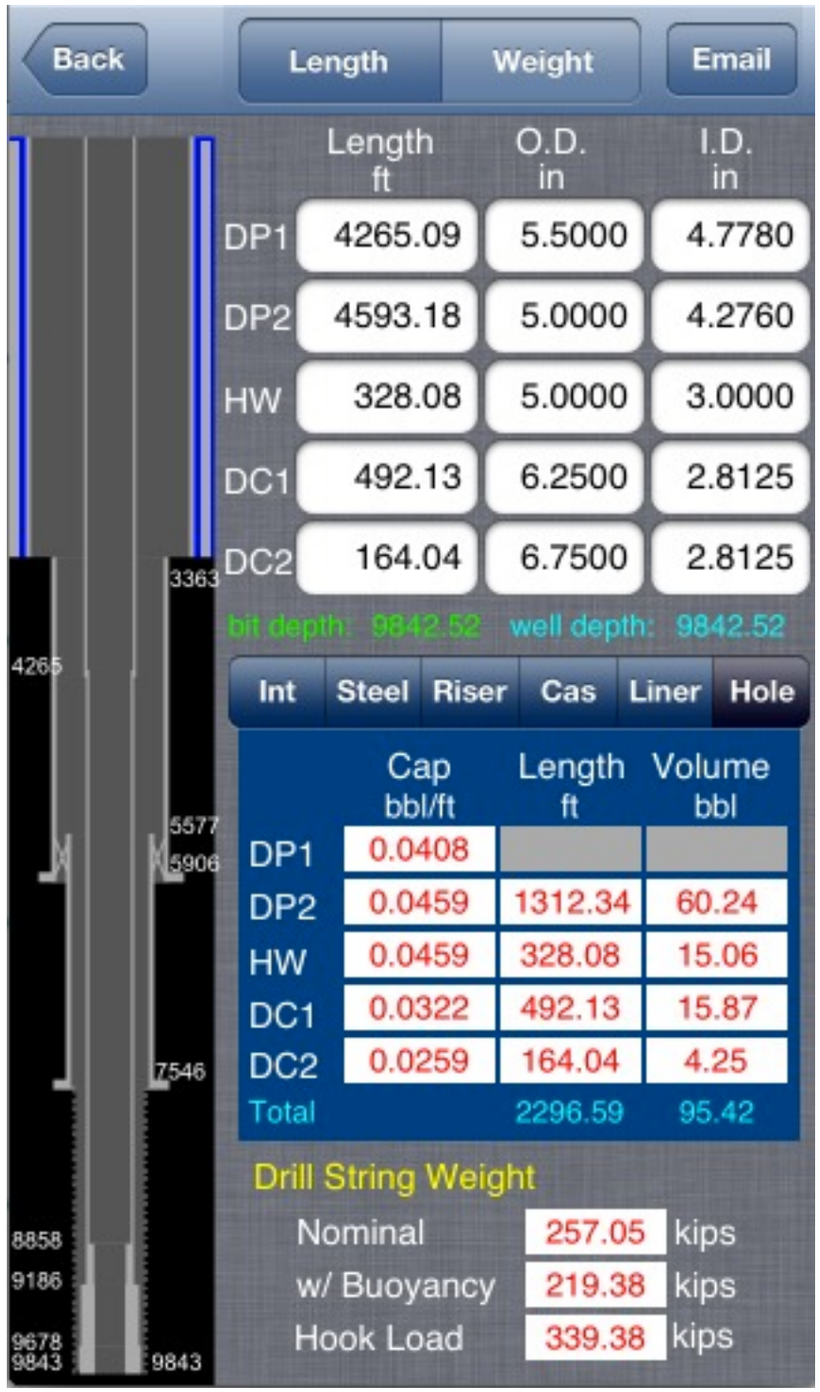


iPhone 5 / iPod Touch 5 gen

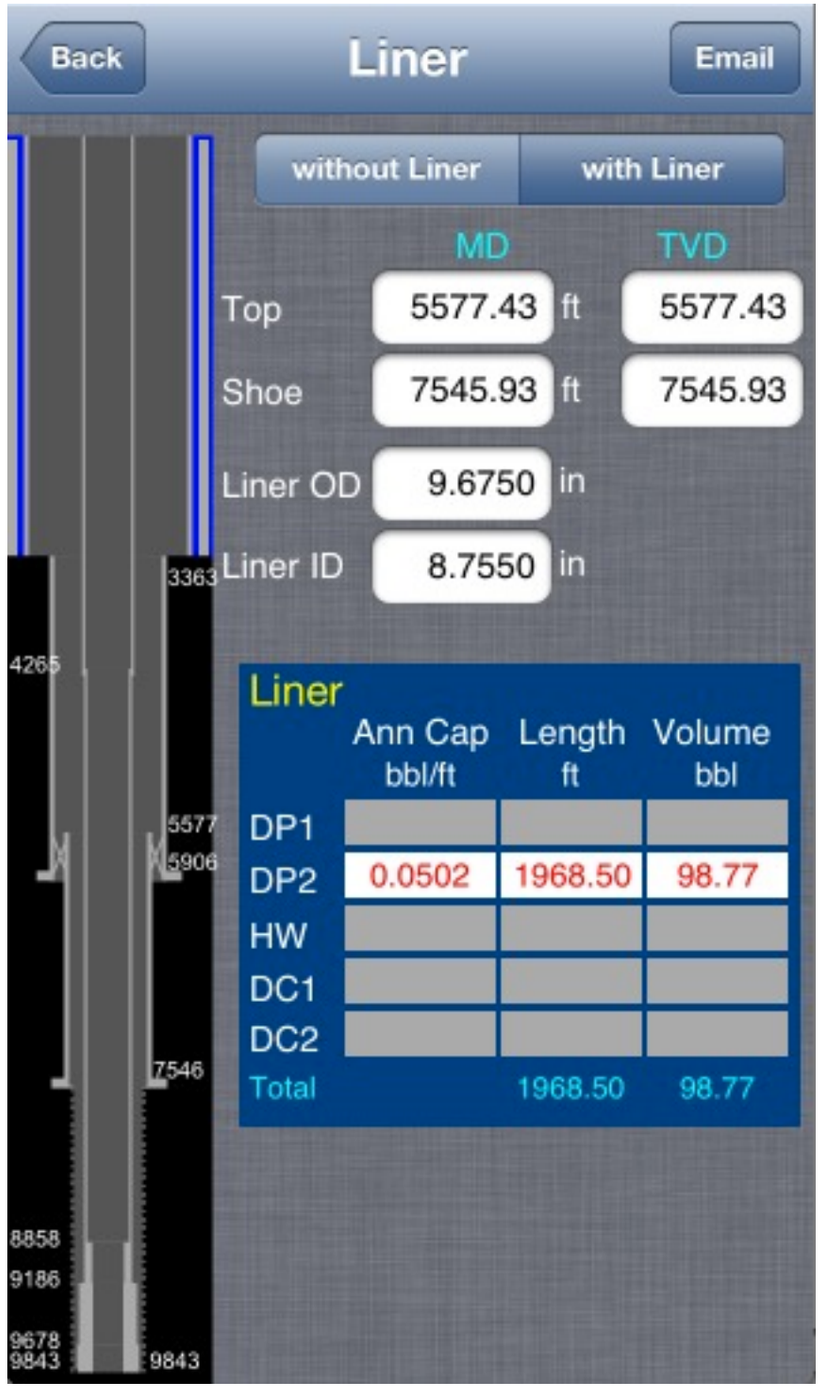
Section Internal Volume



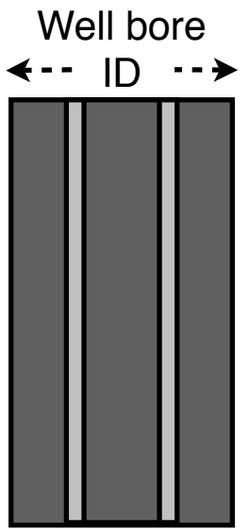
Wellbore x Drill String annular



Internal Liner x Drill String annular



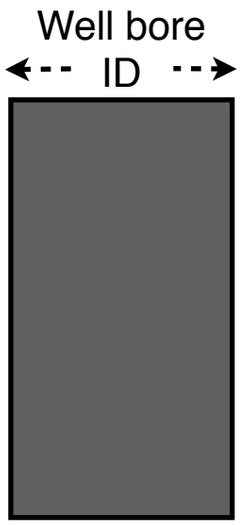
Internal Volume (just volume of fluid)
Calculated without the steel volume (drill string)



strokes	Cap Int bbl/ft	Length ft	Volume * bbl
CL/KL	0.0087	3362.86	29.40
Riser	0.3415	3362.86	1124.31
Casing	0.1497	2214.57	316.54
Liner	0.0745	1968.50	133.74
Hole	0.0702	2296.59	126.64
Total	w/o steel	w/ steel	1760.03

Total Internal Volume
(volume of fluid + volume of steel)

strokes	Cap Int bbl/ft	Length ft	Volume * bbl
CL/KL	0.0087	3362.86	29.40
Riser	0.3415	3362.86	1148.55
Casing	0.1497	2214.57	331.60
Liner	0.0745	1968.50	146.58
Hole	0.0702	2296.59	161.20
Total	w/o steel	w/ steel	1846.74



Drill String
ID

strokes →

Strokes with Mud Pump #1

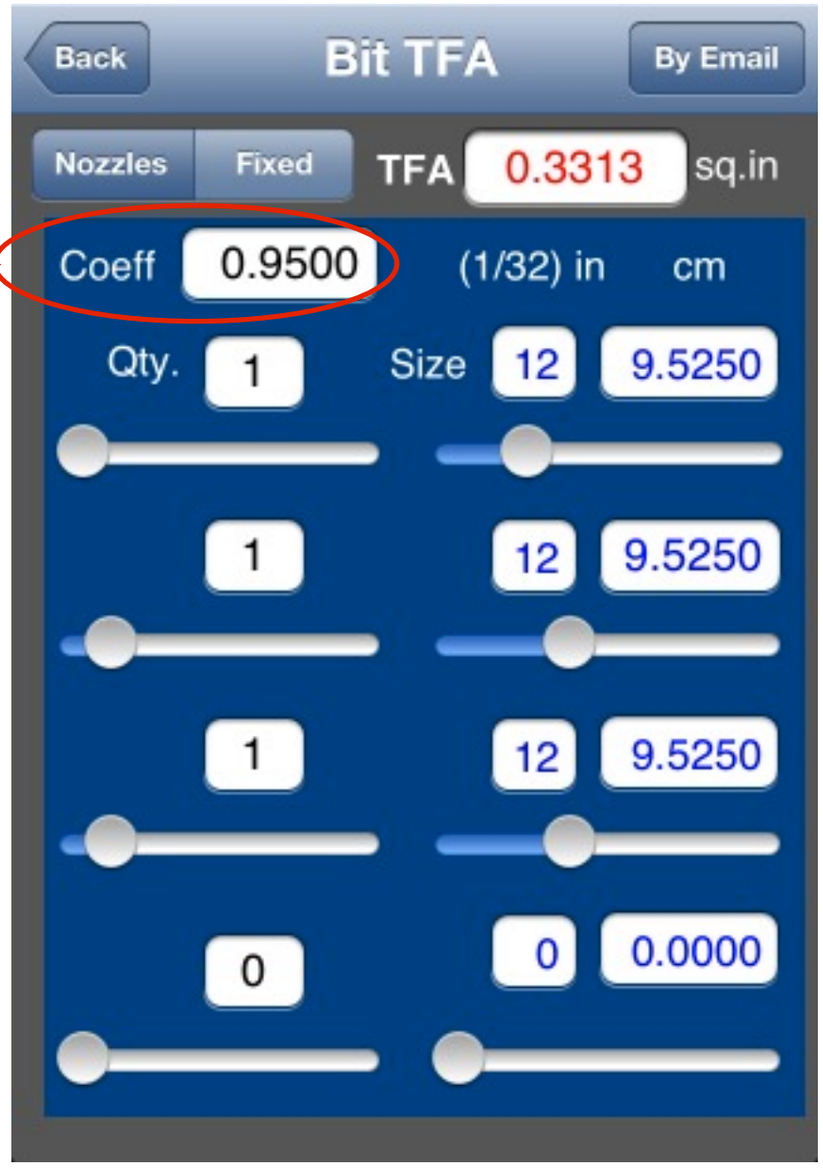
cap/vol	Strokes w/	MP 1	MP 2
Surface to Bit		1557	
Bit to Shoe		798	
Riser Annular		8784	
Bit to BOP		3911	
Choke Line		246	
Bit to Choke		4157	

Strokes with Mud Pump #2

cap/vol	Strokes w/	MP 1	MP 2
Surface to Bit		1573	
Bit to Shoe		807	
Riser Annular		8875	
Bit to BOP		3952	
Choke Line		249	
Bit to Choke		4201	

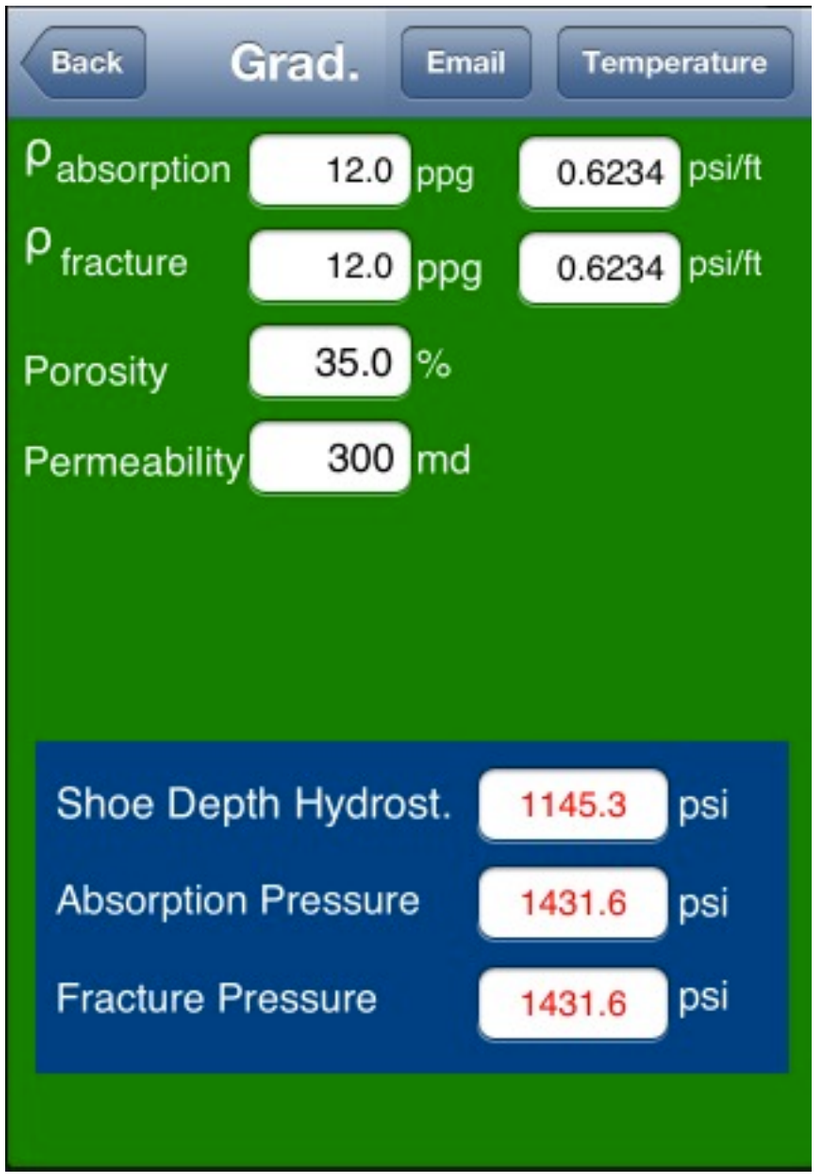
Tap on “Nozzles” option to edit the coefficient and to set until 4 types of nozzles x until 10 units per type to calculate the TFA

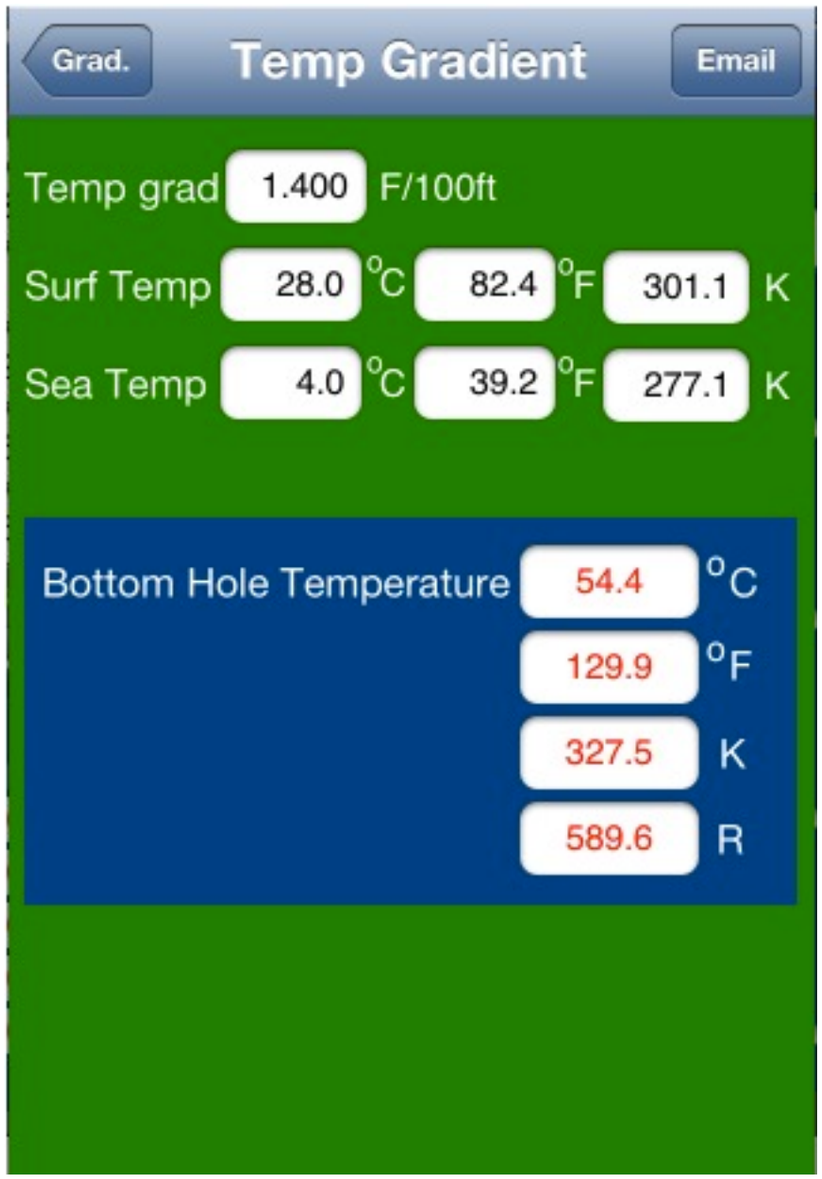
Coefficient



Select “**Fixed**” option to edit the TFA = Total Flow Area

$$\text{Bit Loss} = \frac{\text{MW x Flow}^2}{12032 \text{ x Coeff}^2 \text{ x TFA}^2}$$





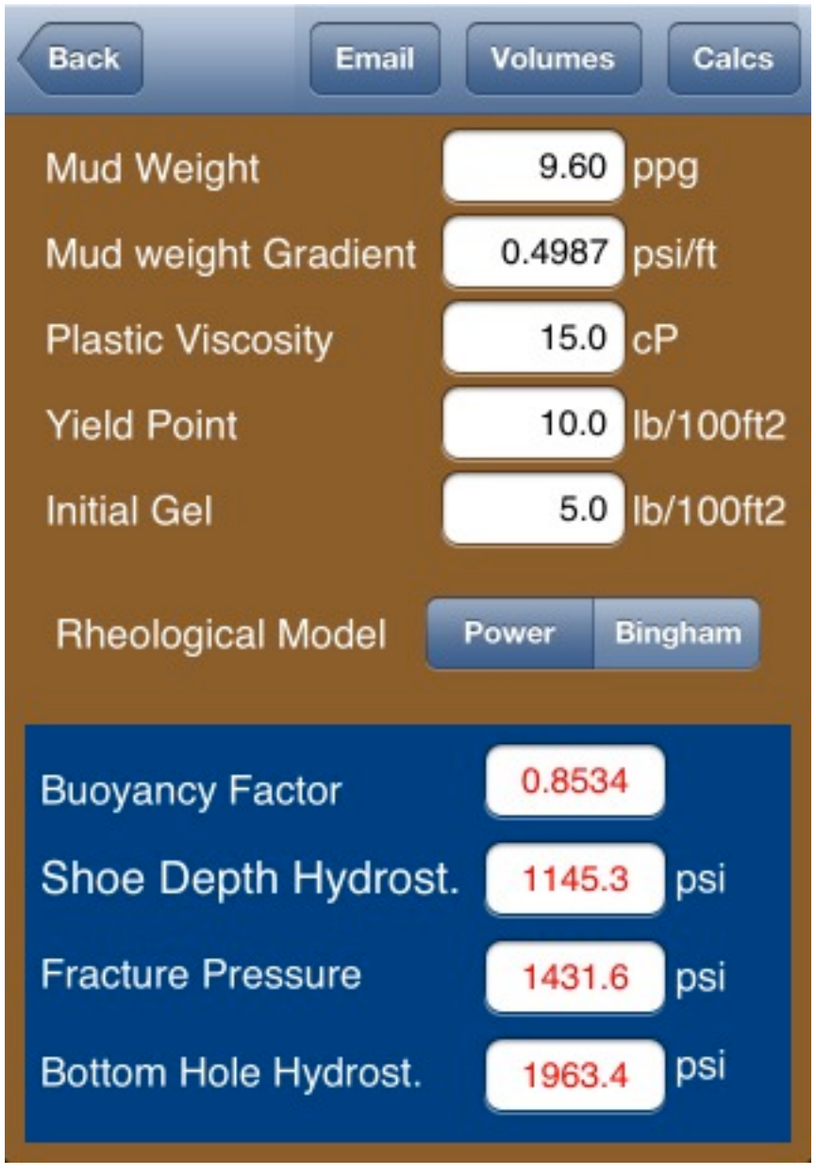
For use with this “Drilling Simulator” app, normally:

Absorption Gradient = Fracture Gradient

This parameter is used just for compatibility with the apps "Well Control Simulator" and "LOT Simulator".

This app works just with the parameters used in the hydraulics calculations:

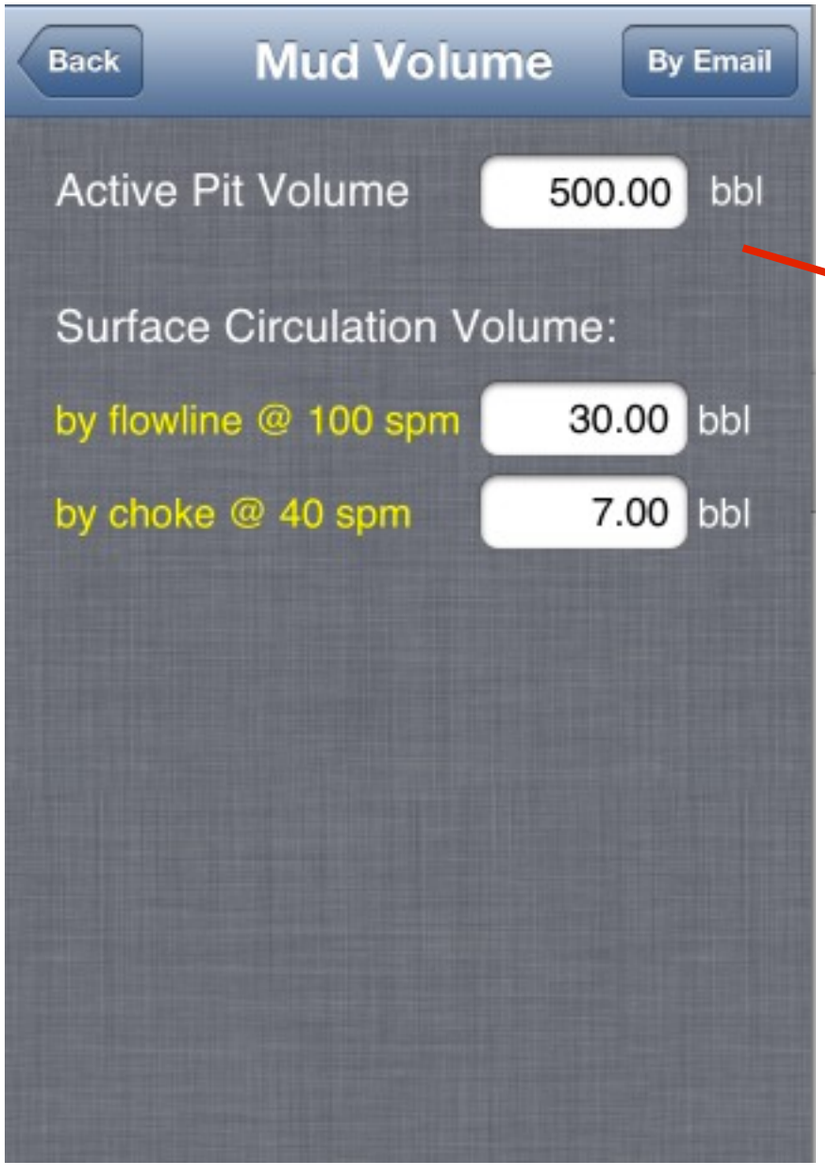
→ **Mud Weight, Plastic Viscosity, Yield Point and Initial Gel**

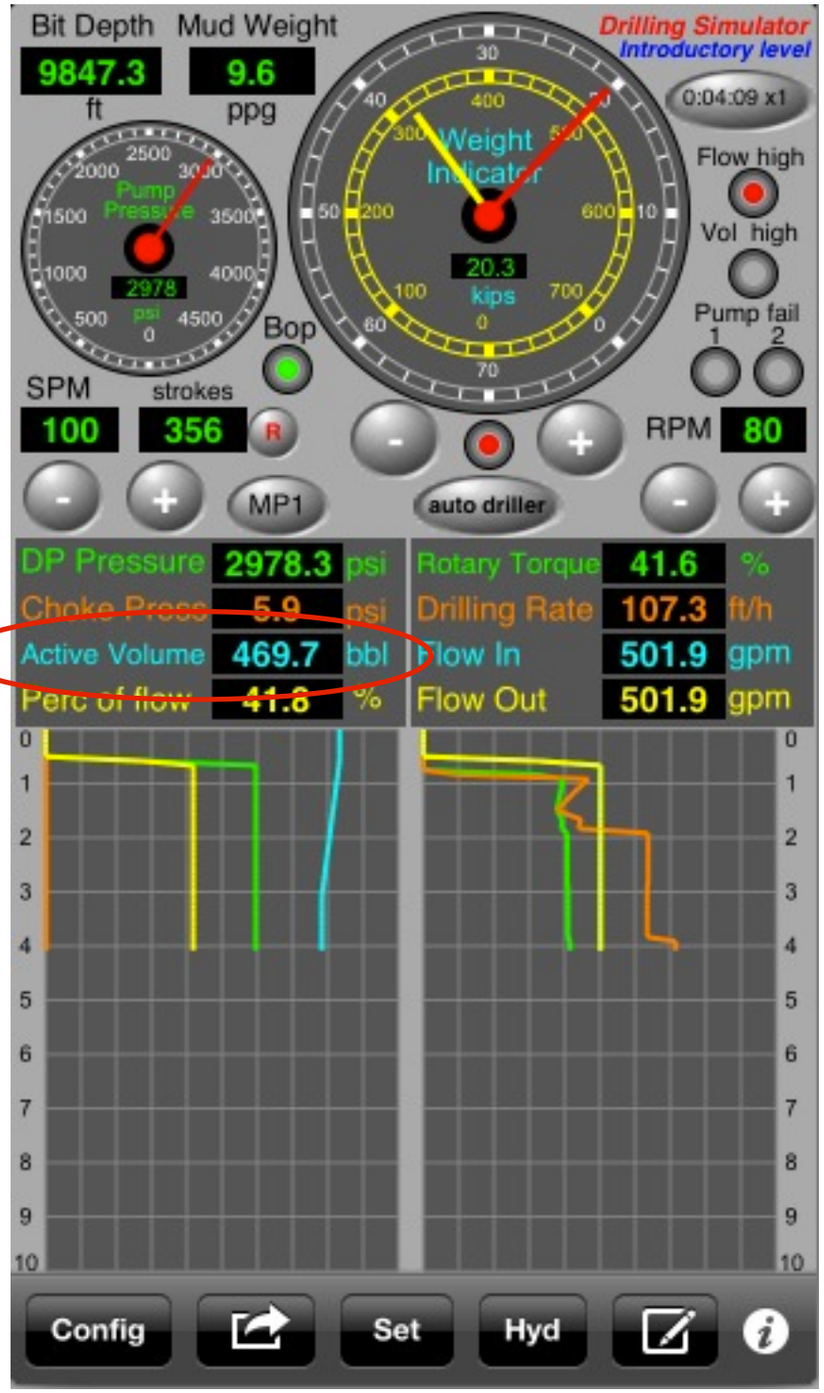


Edit the Active Pit Volume. This parameter is shown on graph on Main View.

The Choke parameters are used just for compatibility with the app "Well Control Simulator".

Note: This simulator does not allows circulation through the choke.



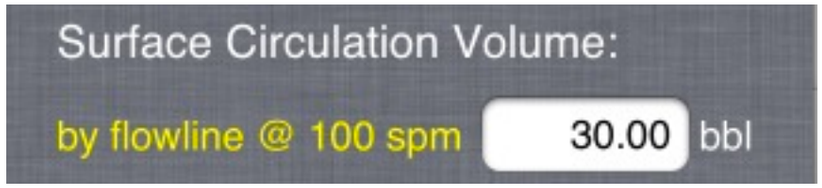


About the Surface Circulation Volume (SCV):

Surface Circulation Volume = Volume of the flow line, pipes, etc when circulating at the surface.

When occur a kick on the drilling, the driller stops the mud pump and the "Surface Circulation Volume" return to tank.

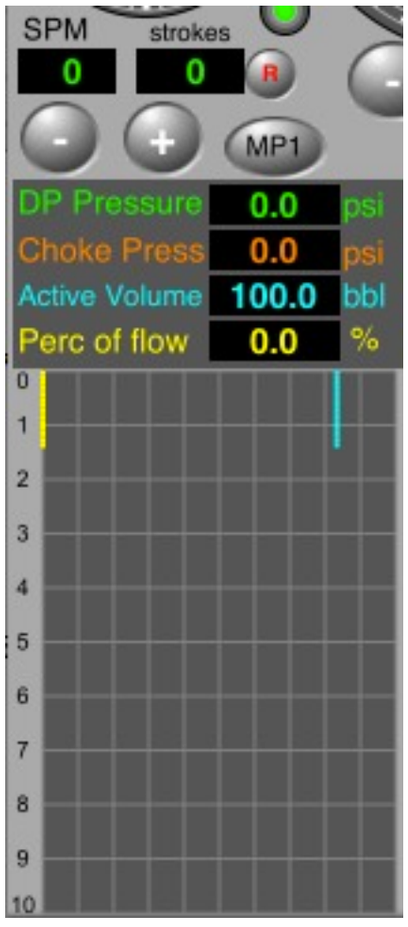
The calculation of the real volume of the kick = Static Vol. after shut-in the well - Dynamic Volume on drilling - Surface Circulation Volume.



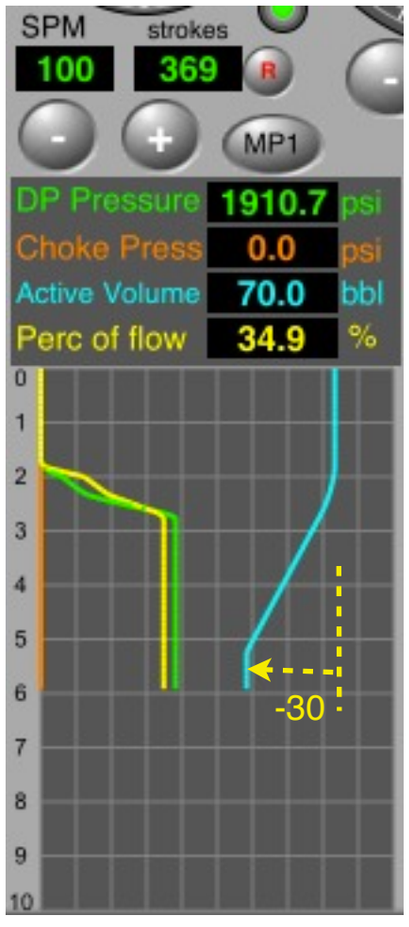
Example: Static Volume (mud pump stopped) = 100 bbl
Drilling with mud pump @ 100 spm => Dynamic Volume = 70 bbl

- **Surface Circulation Volume @ 100 spm = 30 bbl**
- **Shut-in the well => pit volume = 110 bbl**
- **Kick Volume = 110 - 70 - 30 = 10 bbl**

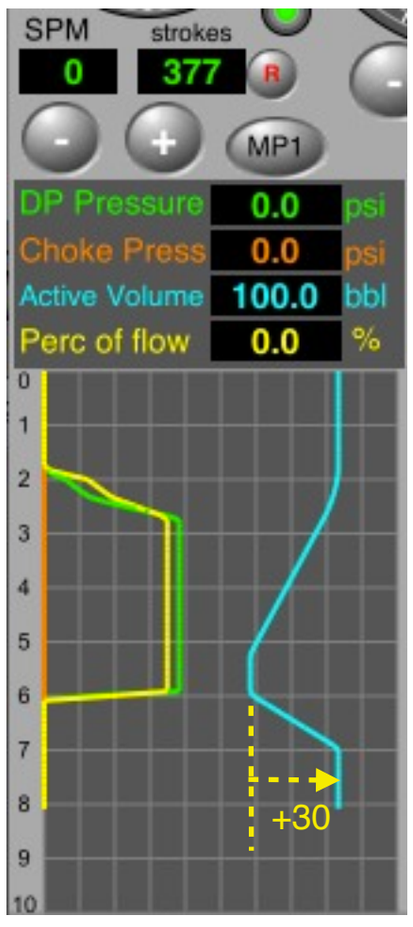
SPM = 0 (mud pump stopped)
Active Volume = 100 bbl
SCV = 0 bbl



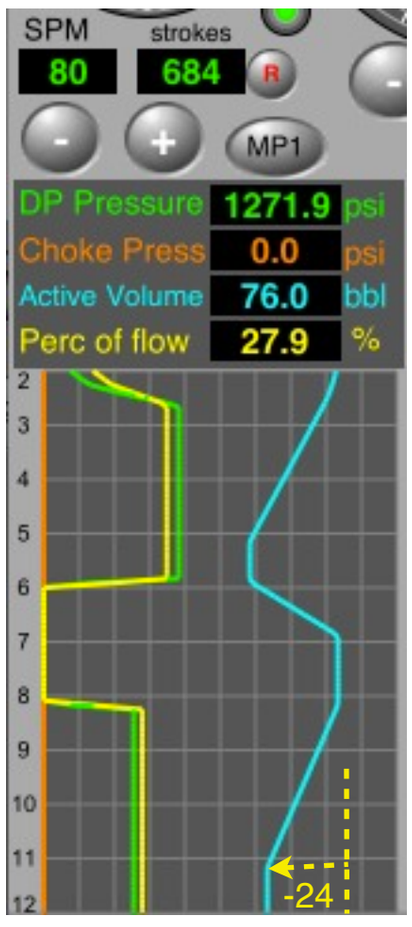
SPM = 100
Dynamic Volume = 70 bbl
SCV = 30 bbl



SPM = 0
Static Volume = 100 bbl
SCV = 0 bbl



SPM = 80
Dynamic Volume = 76 bbl
SCV = 24 bbl



Set 4 parameters for each formation:

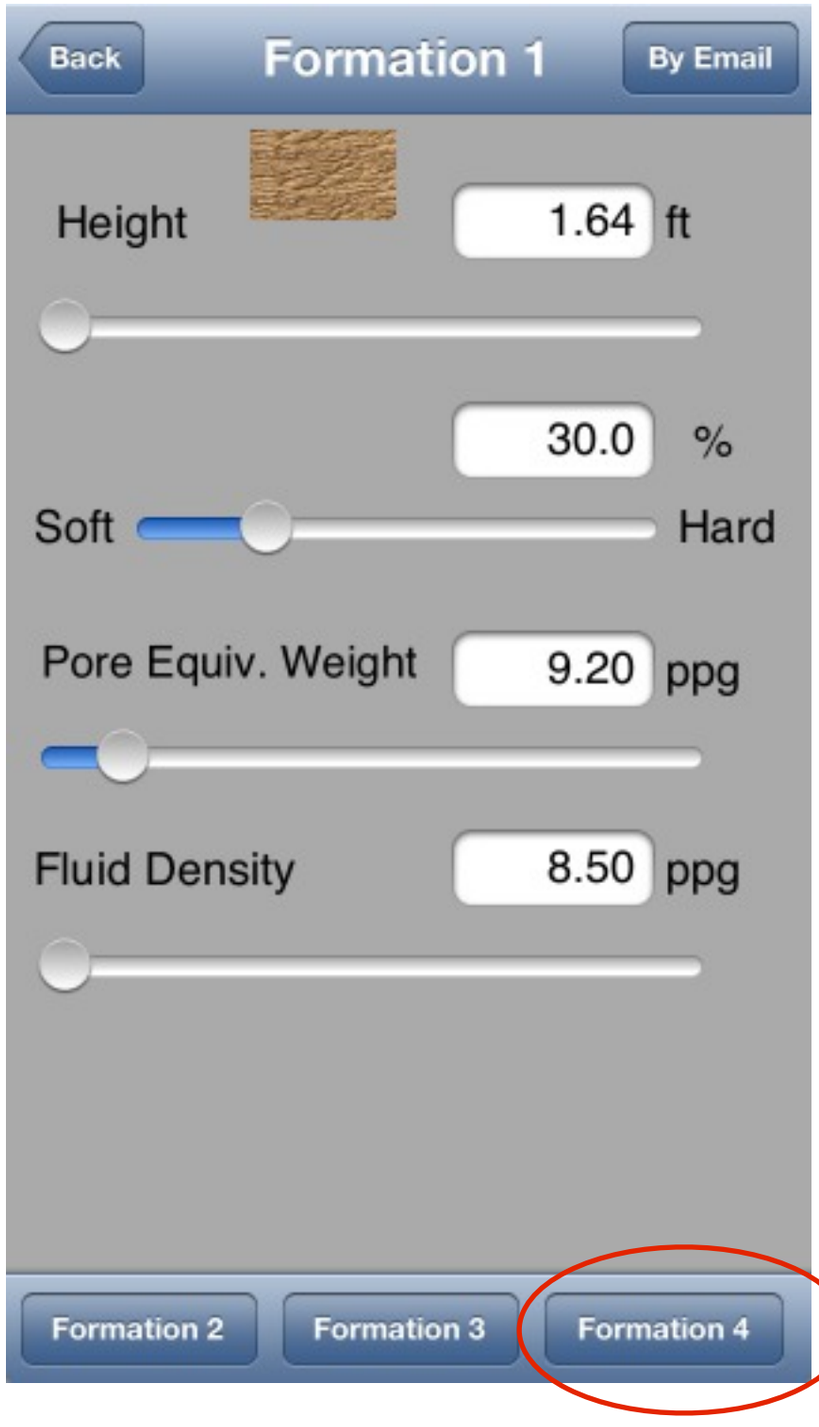
- Height
- Pore Equivalent Weight
- Soft <--> Hard to drill
- Fluid Density in the formation

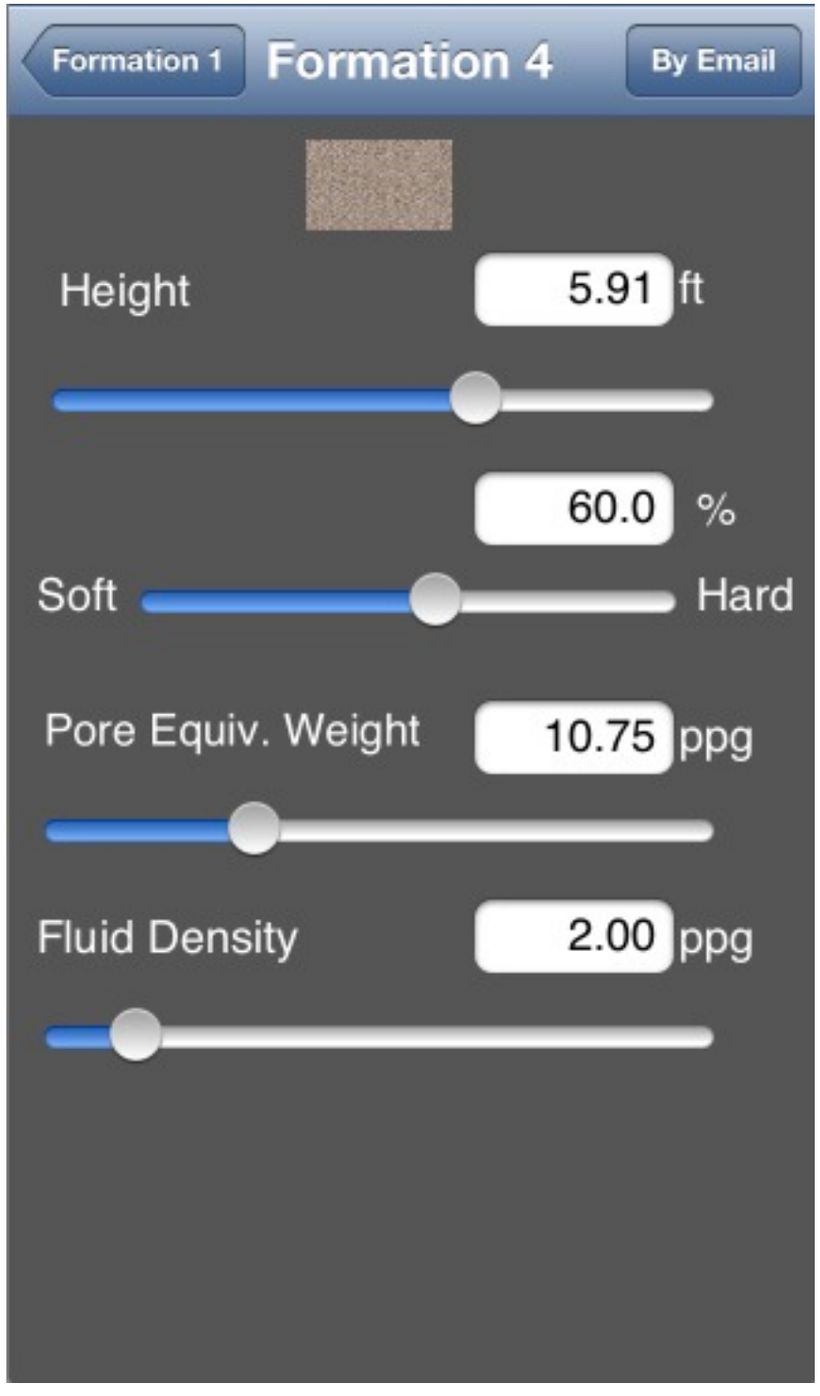
Note:

Fluid Density minimum = 8.50 ppg
to the formations 1, 2 and 3

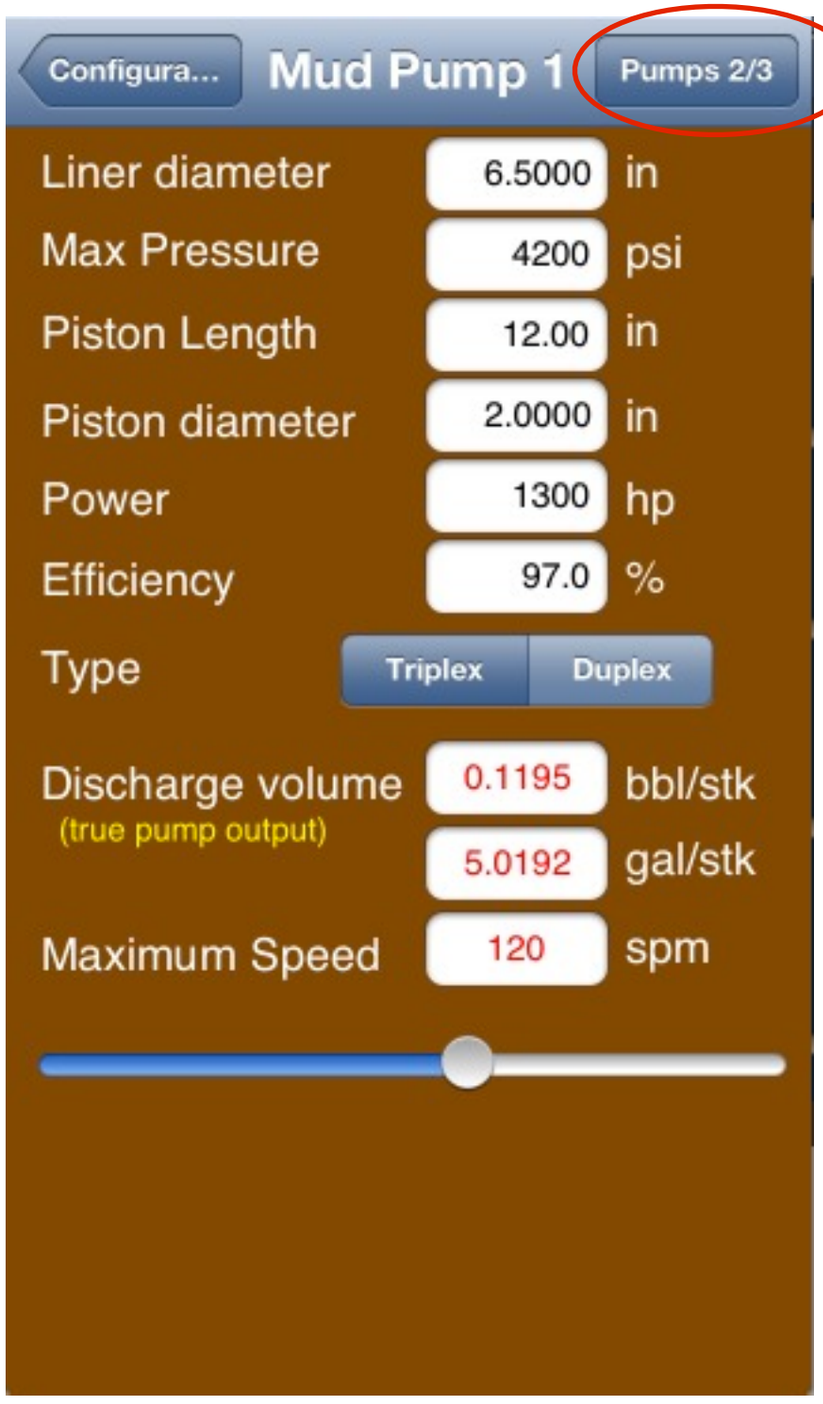
Only to the formation #4:

Fluid Density >= 1.0 ppg



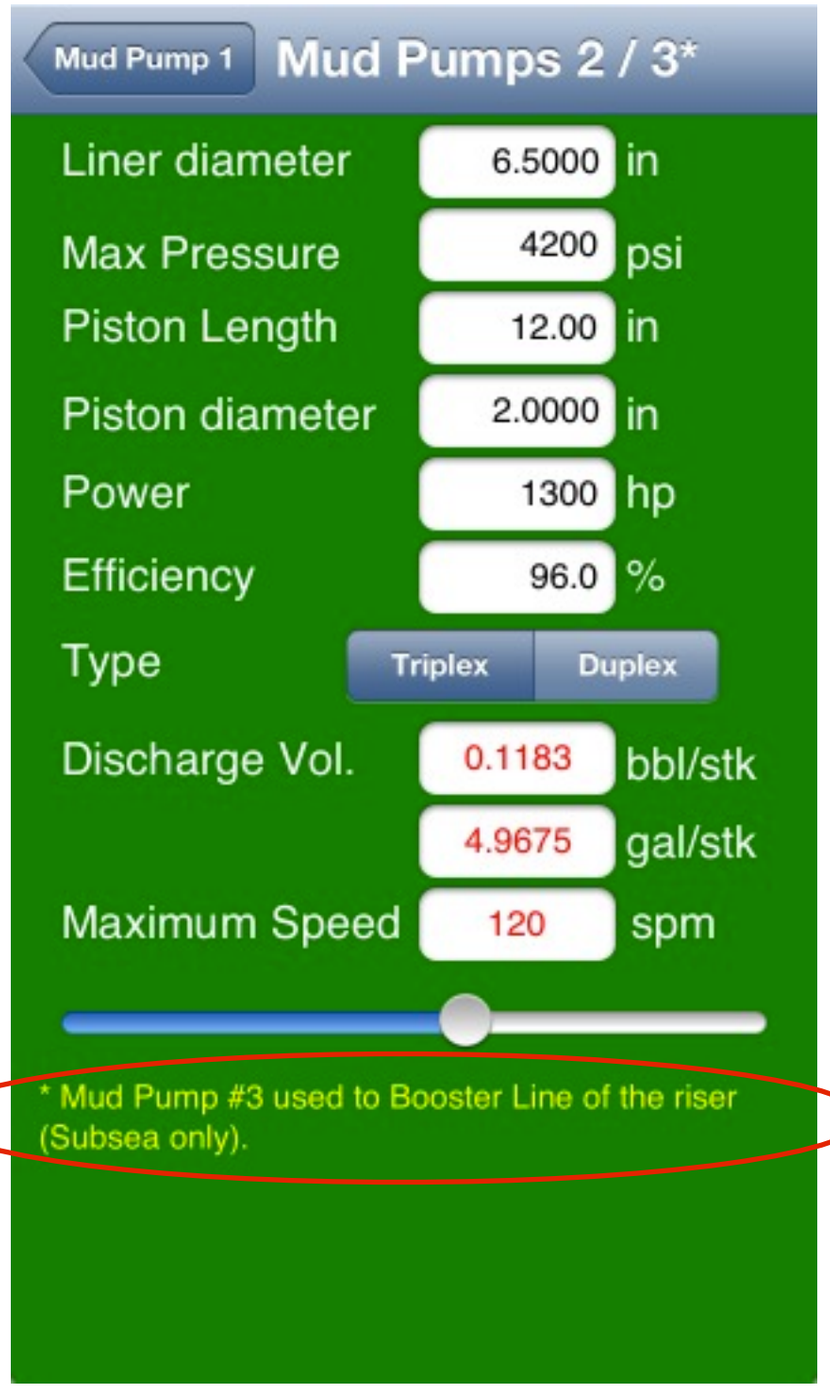


Use mud pumps 1 and 2 to align to drill string



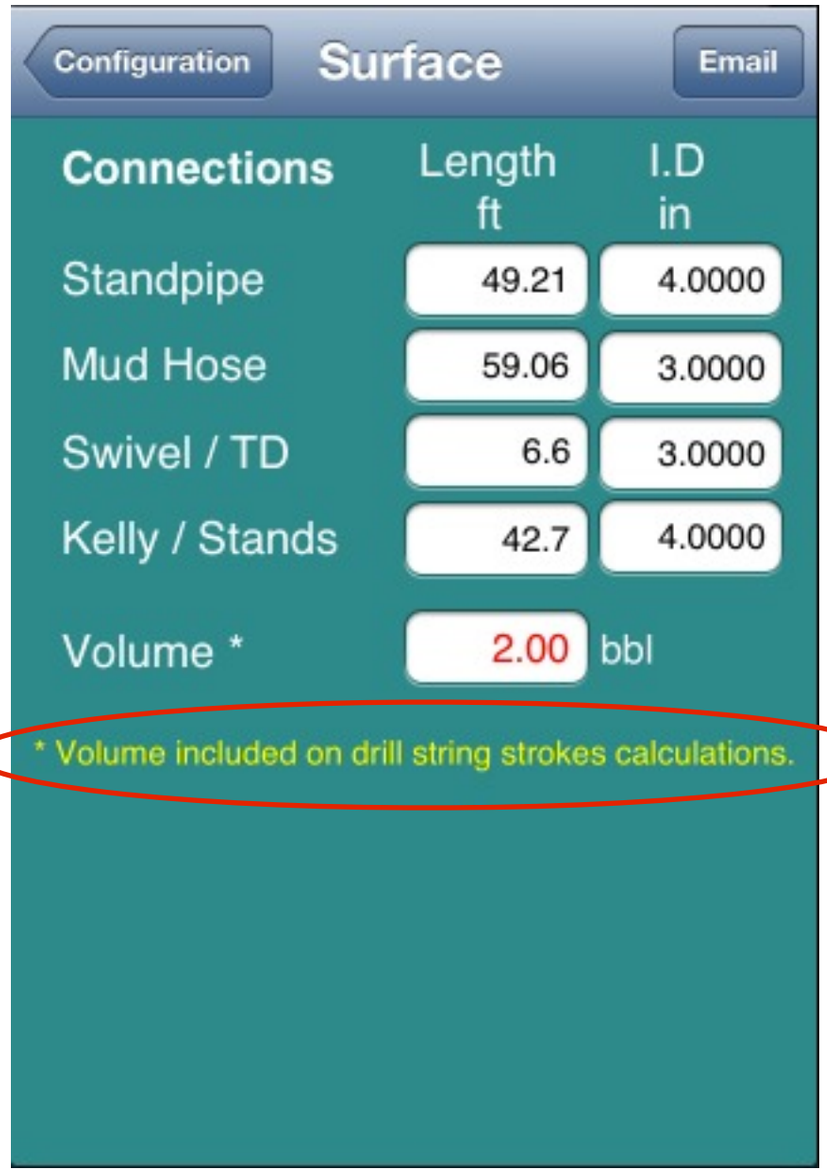
Mud Pump #3:

The same parameters of the mud pump #2.
It is used to **Booster Line** of the riser (Subsea only).



Mud Pump to Booster Line

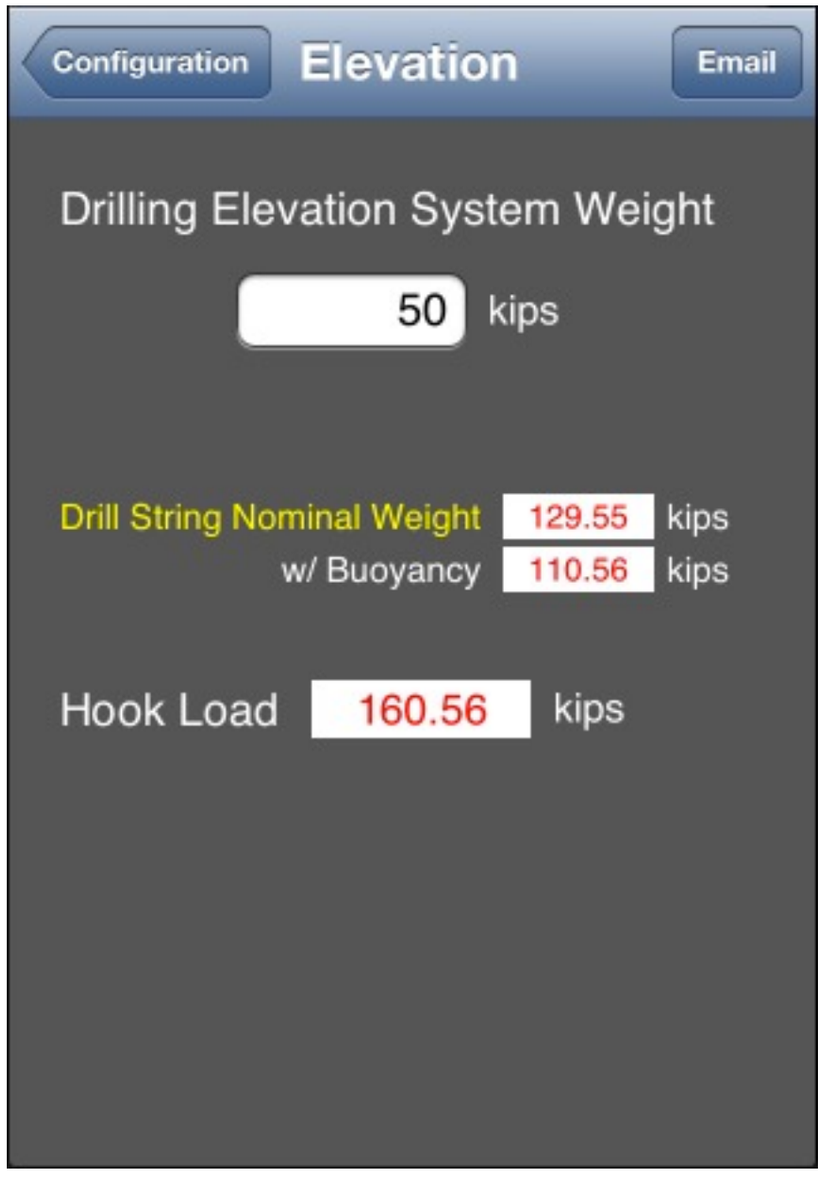
Edit the length and ID parameters for Standpipe, Mud Hose, Swivel/TD and Kelly/Stands



Note:
This volume is included
on drill string strokes calculations

Edit the parameter “Elevation System Weight”. The “Drill string Nominal Weight” is calculated with the drill string parameters.

Hook Load = “Drill string nominal weight **with buoyancy**” + “Elevation System Weight”



Buoyancy Factor

= 1 - Mud Weight (ppg) / 65.5

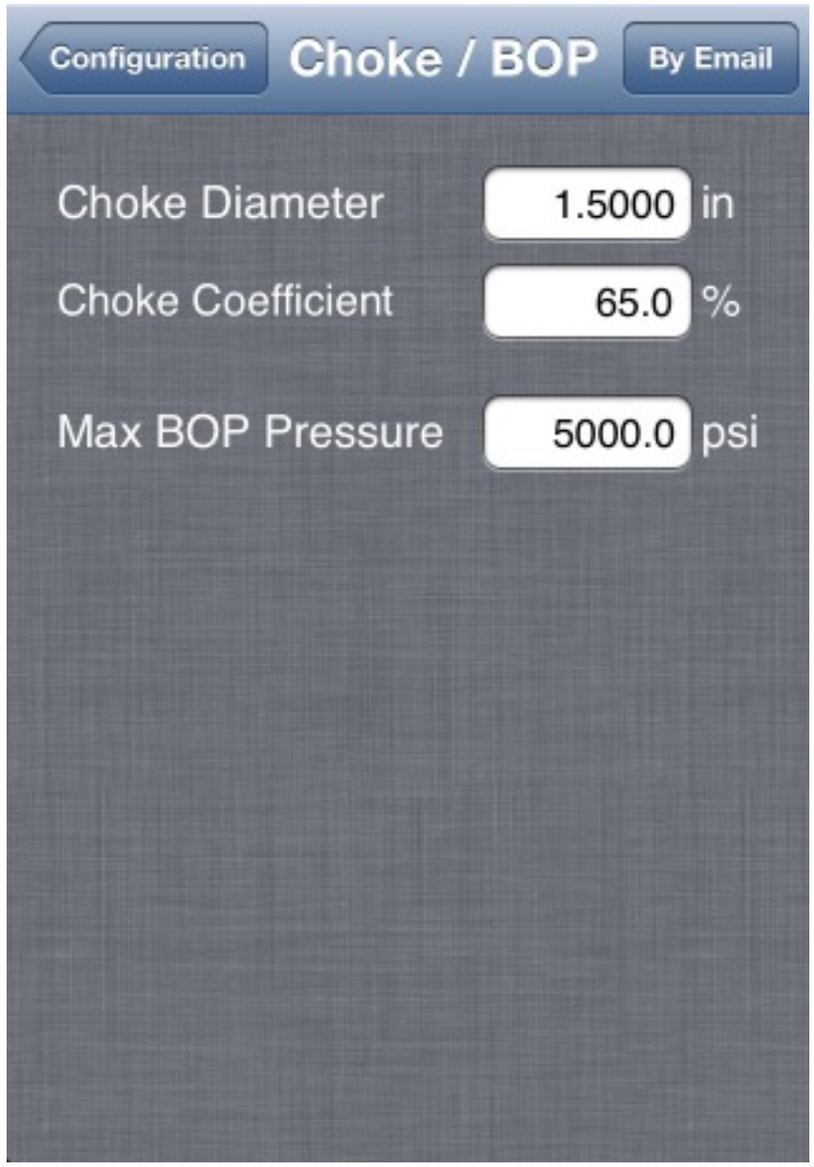
The Choke parameters are used just for compatibility with the app "Well Control Simulator".

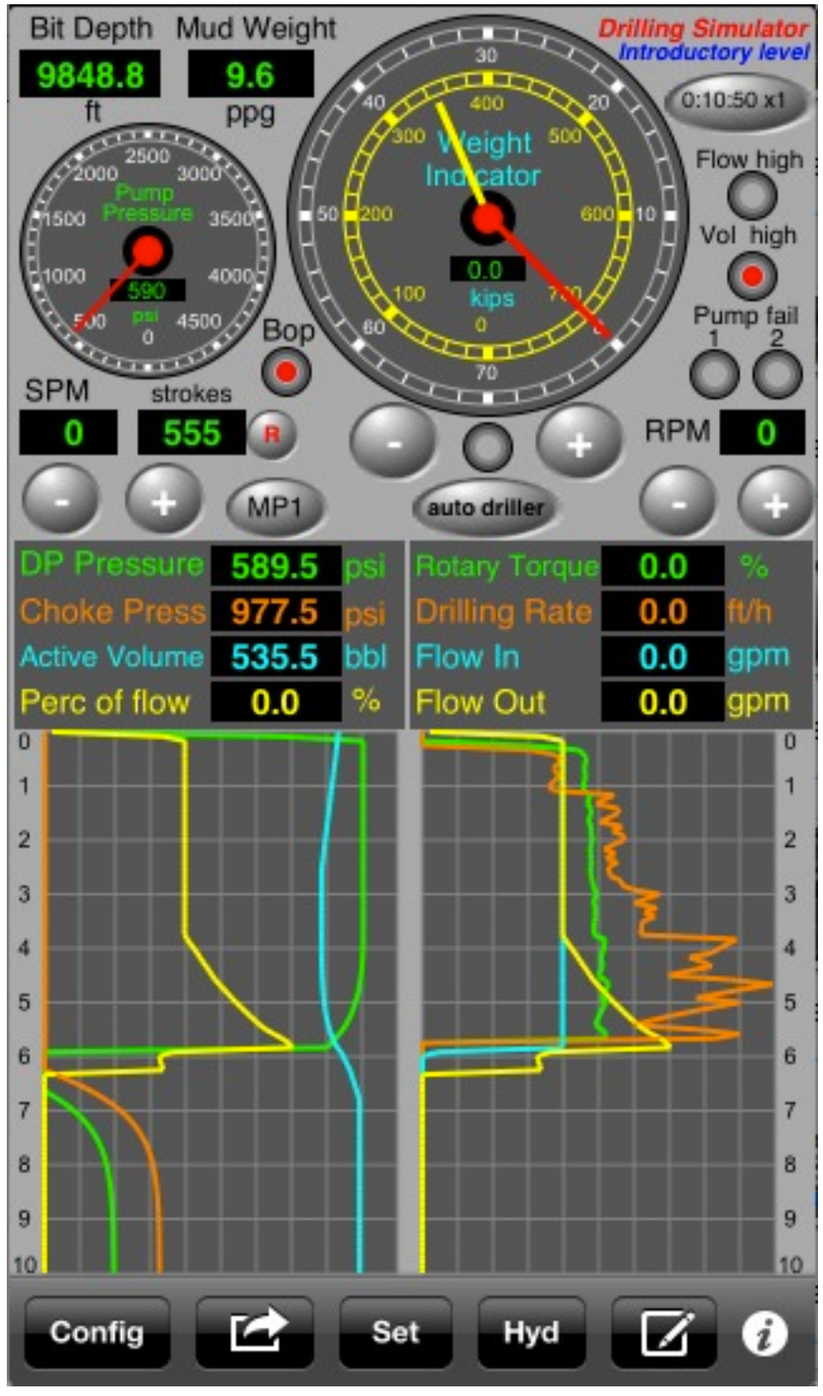
Note: This simulator does not allows circulation through the choke.

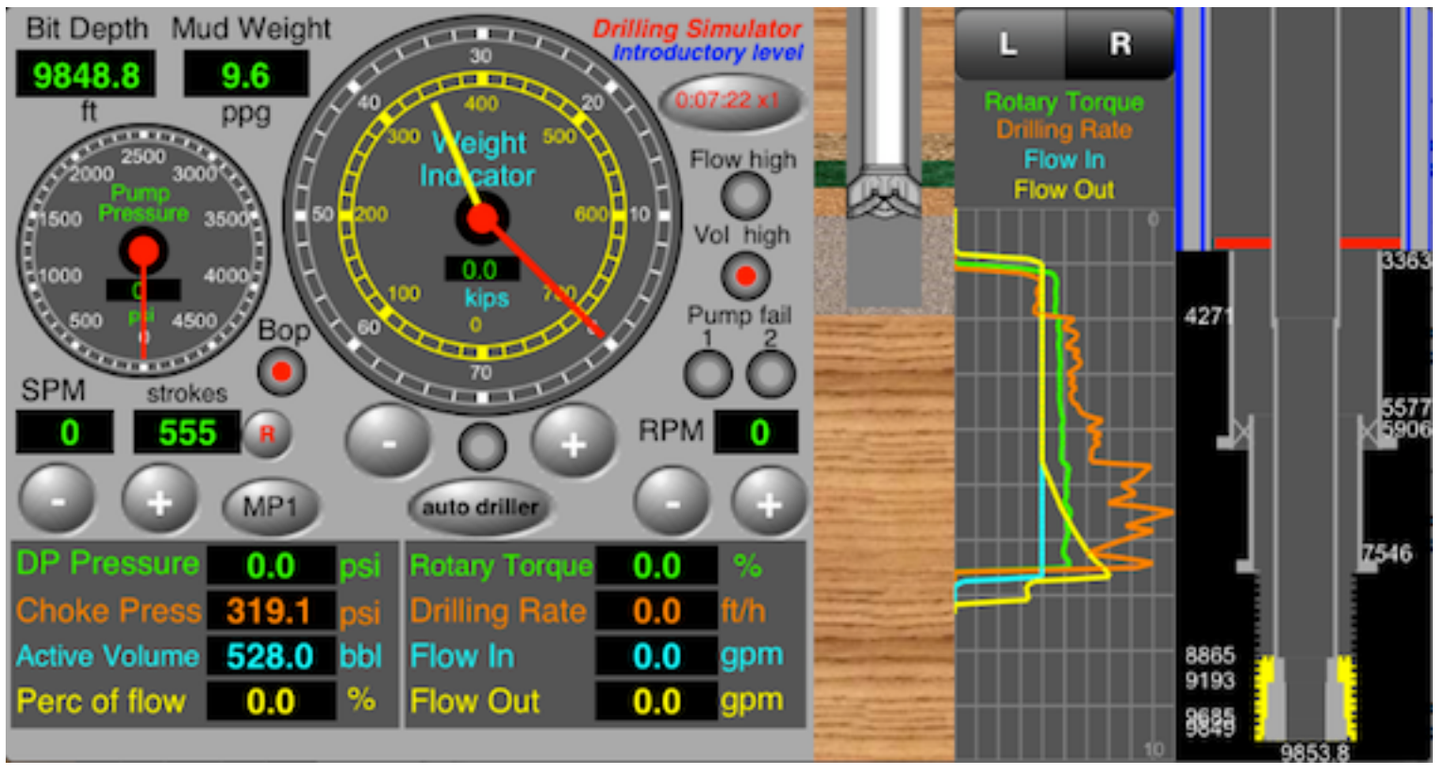
Notes for this simulator:

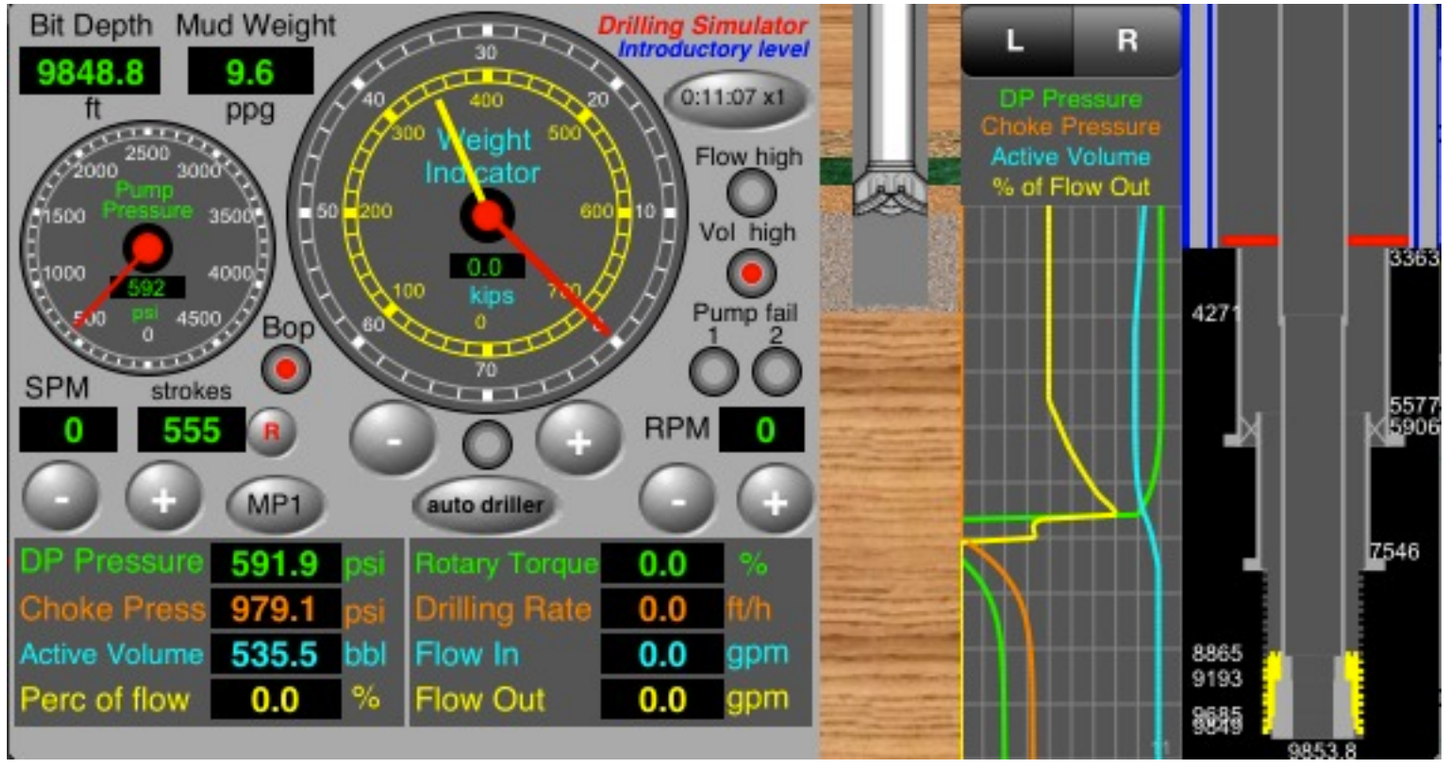
1. if the pressure in the BOP is greater
than the maximum BOP pressure,
the BOP fails with subsequent blowout.

2. If the BOP is closed and set RPM > 0, BOP fails.
Use this for blowout simulation.




Bit Depth
Mud Weight
9848.8
ft
9.6
ppg
Drilling Simulator
Introductory level
0:10:50 x1
Pump Pressure
590
psi
Weight Indicator
0.0
kips
Flow high
Vol high
Pump fail
1 2
Bop
SPM
strokes
0
555
R
RPM
0
MP1
auto driller
DP Pressure 589.5 psi
Choke Press 977.5 psi
Active Volume 535.5 bbl
Perc of flow 0.0 %
Rotary Torque 0.0 %
Drilling Rate 0.0 ft/h
Flow In 0.0 gpm
Flow Out 0.0 gpm
Config
Set
Hyd


Bit Depth
Mud Weight
9848.8
ft
9.6
ppg
Drilling Simulator
Introductory level
0:07:22 x1
Pump Pressure
Weight Indicator
0.0
kips
Flow high
Vol high
Pump fail
1 2
Bop
SPM
strokes
0
555
R
RPM
0
MP1
auto driller
DP Pressure 0.0 psi
Choke Press 319.1 psi
Active Volume 528.0 bbl
Perc of flow 0.0 %
Rotary Torque 0.0 %
Drilling Rate 0.0 ft/h
Flow In 0.0 gpm
Flow Out 0.0 gpm
L
R
Rotary Torque
Drilling Rate
Flow In
Flow Out
4271
3363
5577
5906
7546
8865
9193
9853.8


Bit Depth
Mud Weight
9848.8
ft
9.6
ppg
Drilling Simulator
Introductory level
0:11:07 x1
Pump Pressure
592
psi
Weight Indicator
0.0
kips
Flow high
Vol high
Pump fail
1 2
Bop
SPM
strokes
0
555
R
RPM
0
MP1
auto driller
DP Pressure 591.9 psi
Choke Press 979.1 psi
Active Volume 535.5 bbl
Perc of flow 0.0 %
Rotary Torque 0.0 %
Drilling Rate 0.0 ft/h
Flow In 0.0 gpm
Flow Out 0.0 gpm
L
R
DP Pressure
Choke Pressure
Active Volume
% of Flow Out
4271
3363
5577
5906
7546
8865
9193
9853.8

Tap on "**Options**" button on toolbar to select a circulation option:

1) Drill pipe -> Flow line ("Riser" on subsea): **circulation option for drilling**

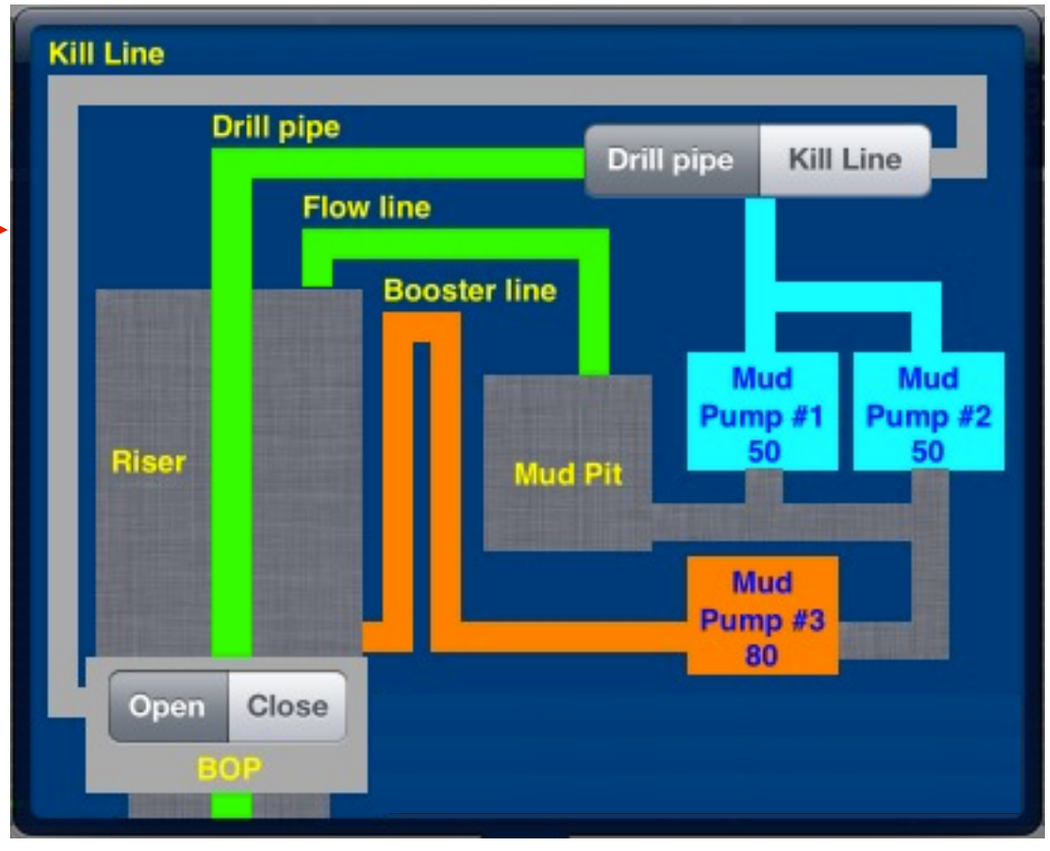
2) Kill Line -> Flow Line ("Riser" on subsea): circulation option for pressure losses in kill / choke lines

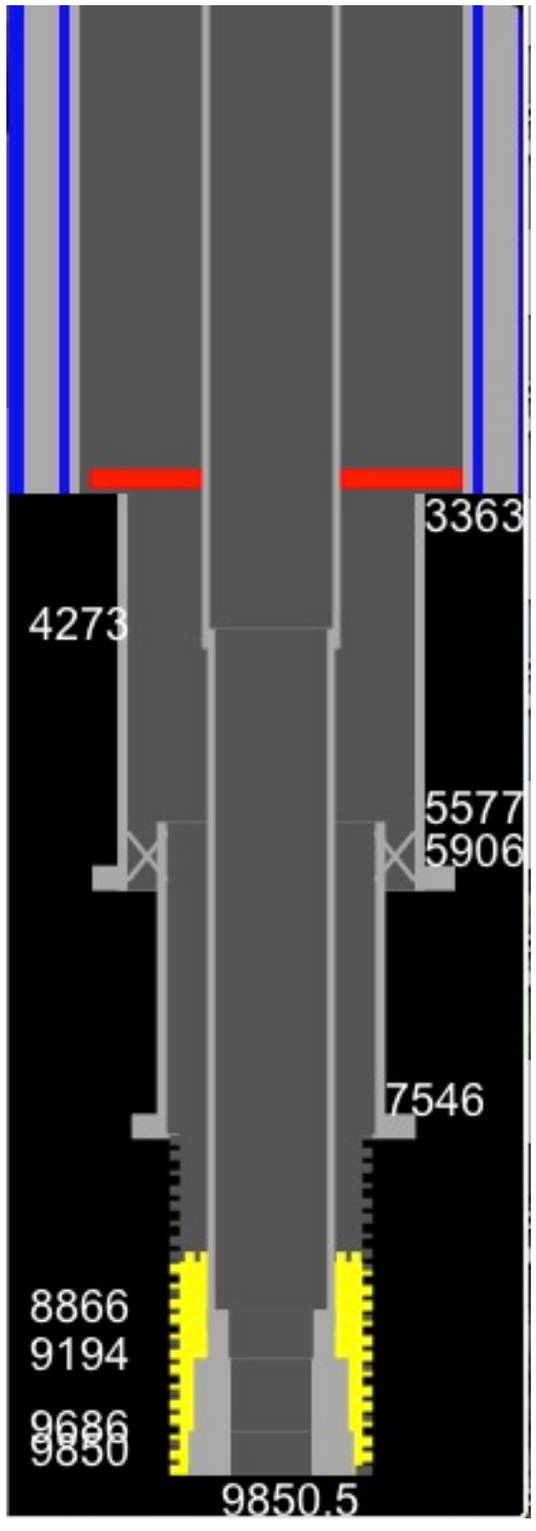
3) Close BOP: No Circulation: option to shut-in the well after to detect kick and to wait stabilization of the pressures (SIDPP and SICP)

Note: This simulator does not allows circulation through the choke.

It is possible to use two mud pumps in parallel (MP #1 and MP #2)

The MP #3 is used to **Booster Line** of the riser (Subsea only) during the drilling to to increase the flow in the riser.





Tap on "**Options**" button on toolbar to select a circulation option:

1) Drill pipe -> Flow line ("Riser" on subsea): circulation option for drilling

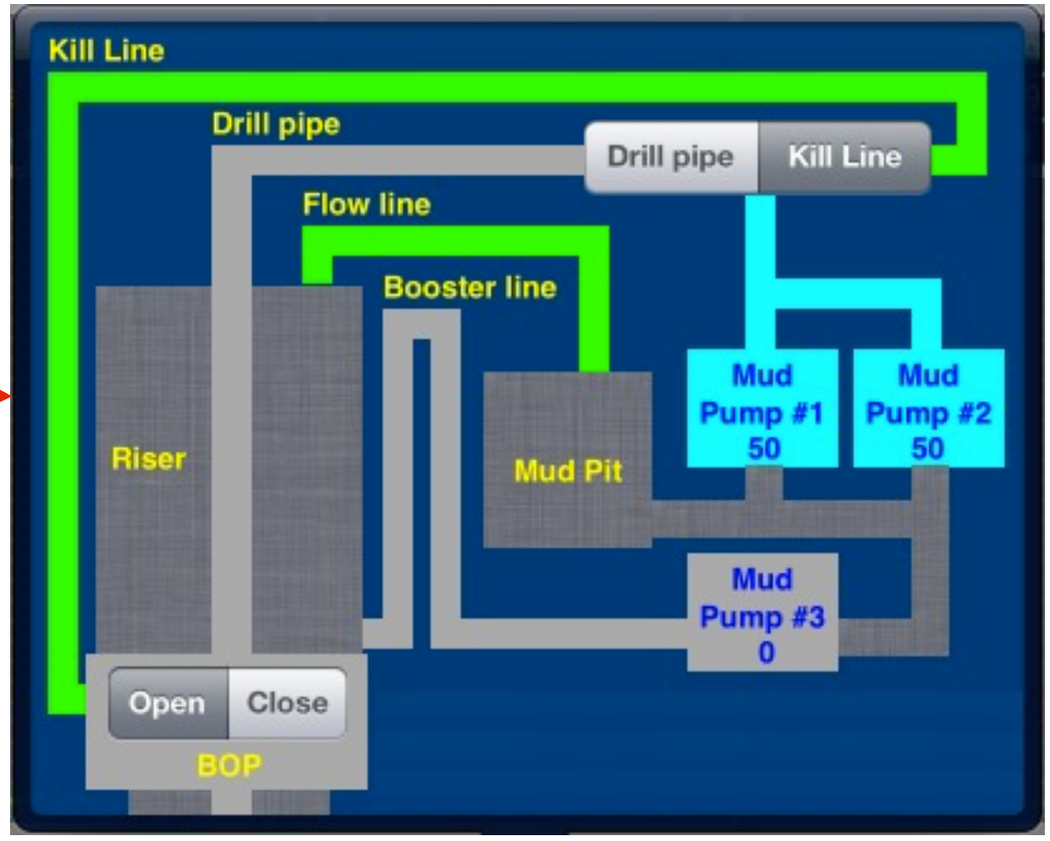
2) Kill Line -> Flow Line ("Riser" on subsea): circulation option for pressure losses **in kill / choke lines**

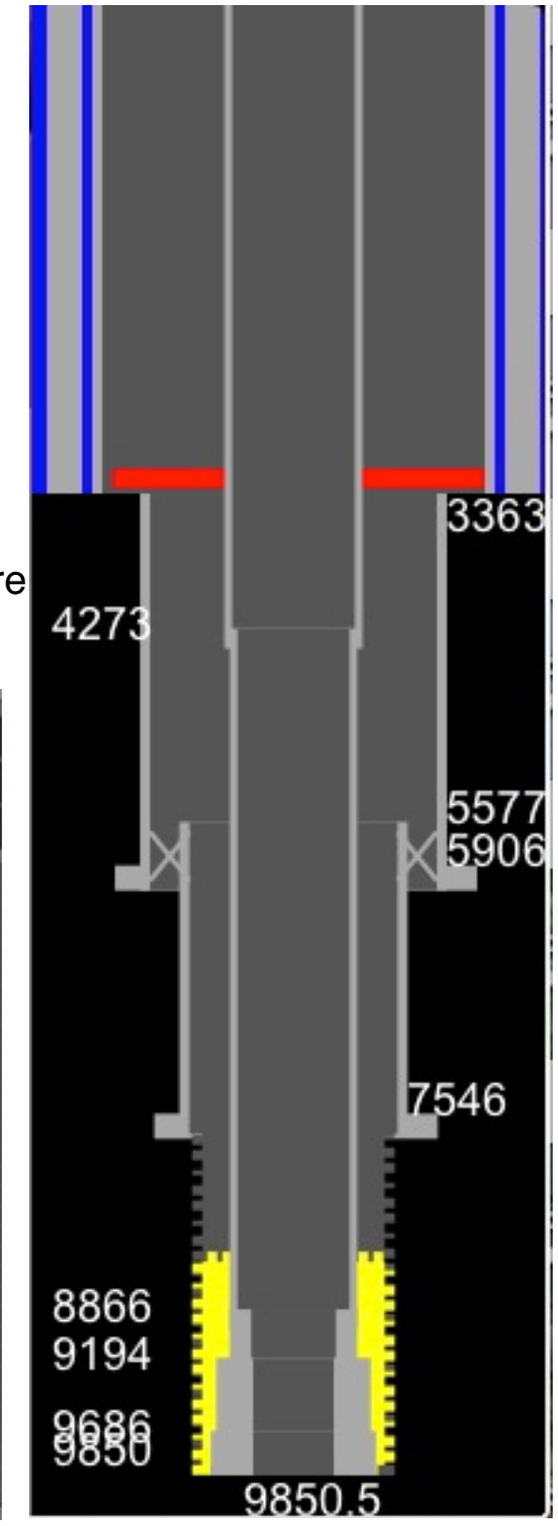
3) Close BOP: No Circulation: option to shut-in the well after to detect kick and to wait the stabilization of the pressures (SIDPP and SICP)

Note: This simulator does not allows circulation through the choke.

To register the pressure losses in kill / choke lines (subsea only), normally is circulated through the kill line returning by riser (flow line) with the mud pump in the kill rate speed.

Kill Pump Pressure => Pressure Loss in Choke line (normally this lines have the same ID) and the pressure losses in the riser are close to zero.





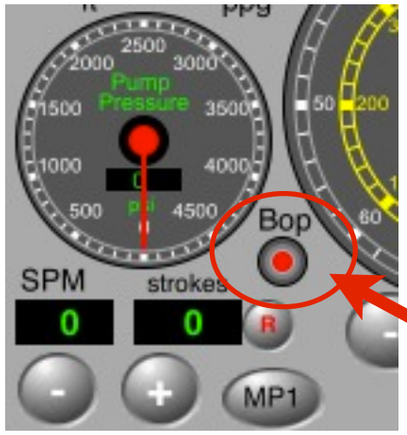
Tap on "**Options**" button on toolbar to select a circulation option:

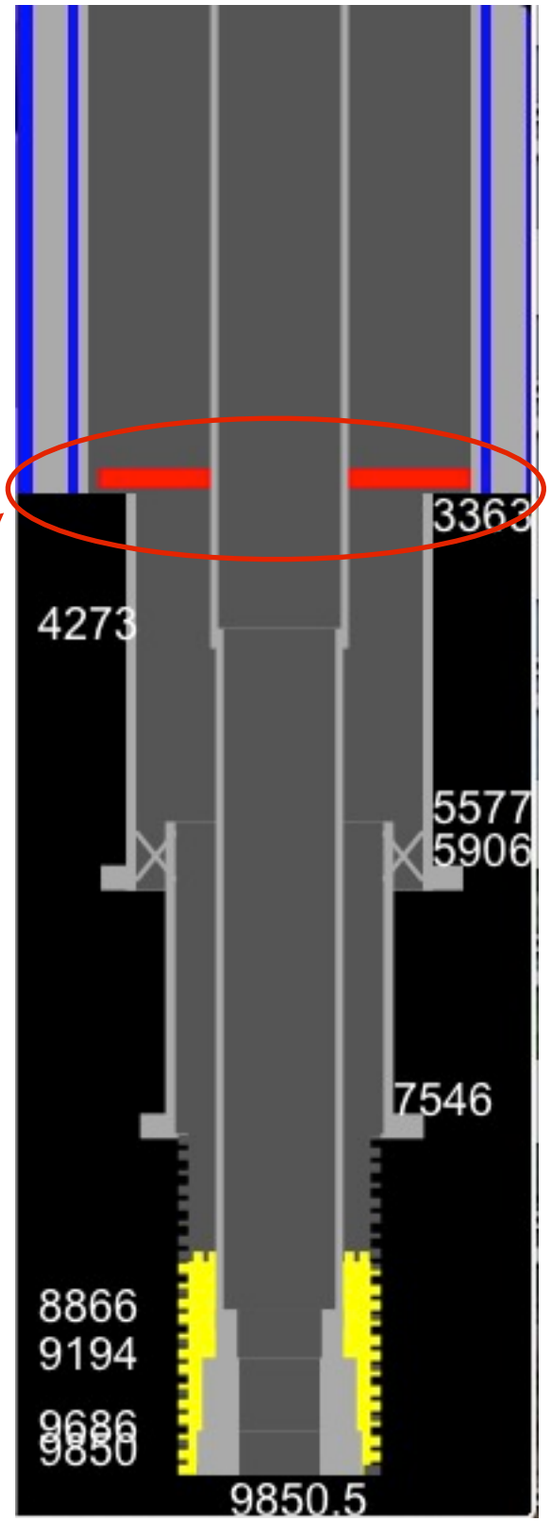
1) Drill pipe -> Flow line ("Riser" on subsea): circulation option for drilling

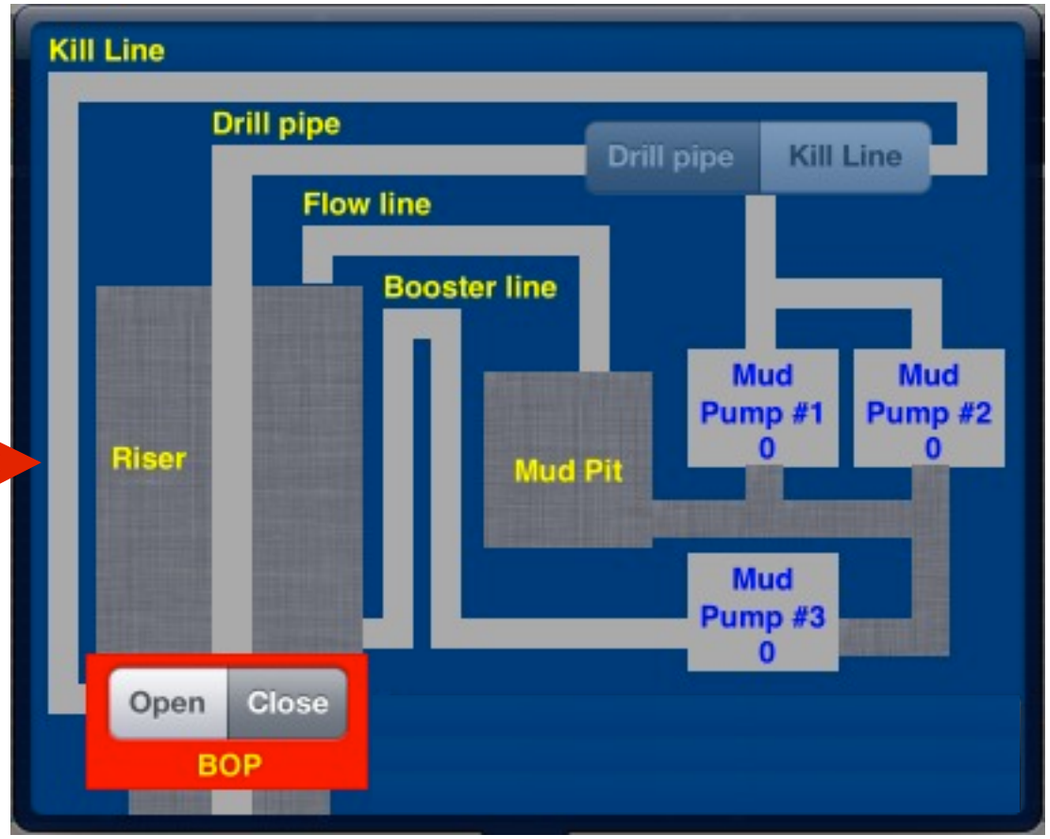
2) Kill Line -> Flow Line ("Riser" on subsea): circulation option for pressure losses in kill / choke lines

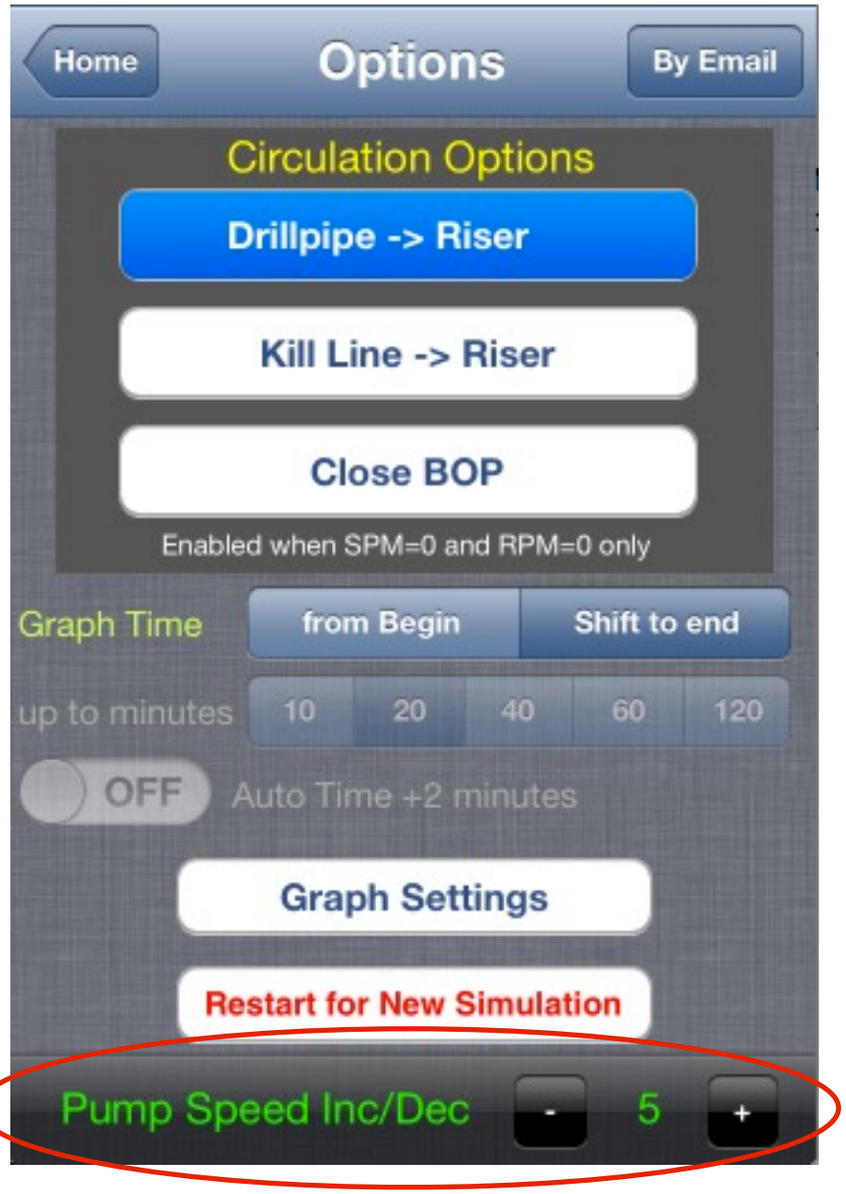
3) Close BOP: No Circulation: **option to shut-in the well after to detect kick and to wait the stabilization of the pressures (SIDPP and SICP)**

Note: This simulator does not allows circulation through the choke.



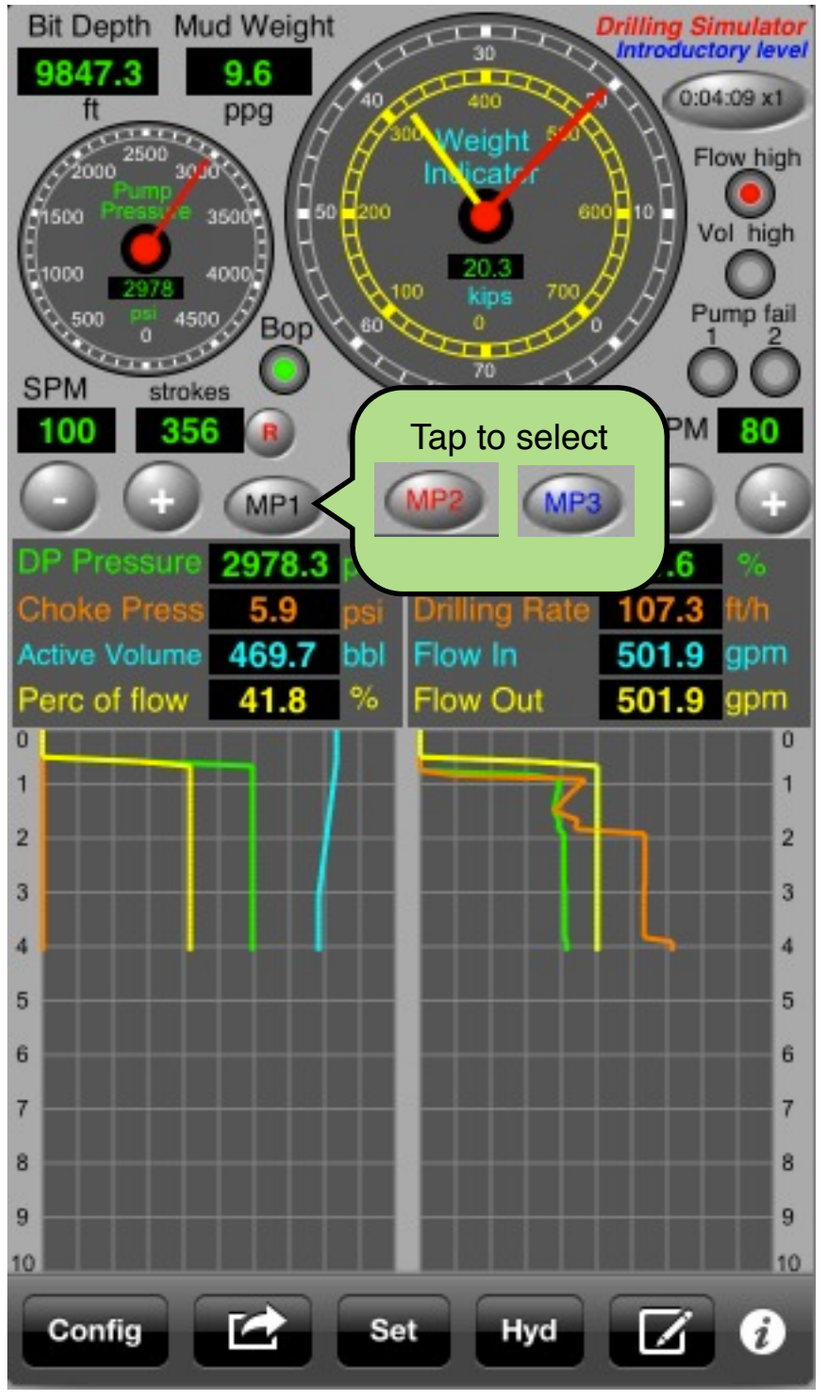






SPM and Strokes with "**Reset**" button

Tap on buttons to set the pump speed for each mud pump:



Flow Rate In / Out

Set the decrement / increment of the pump speed for adjust on buttons.

Range: 1 to 5 spm
Default: 5 spm

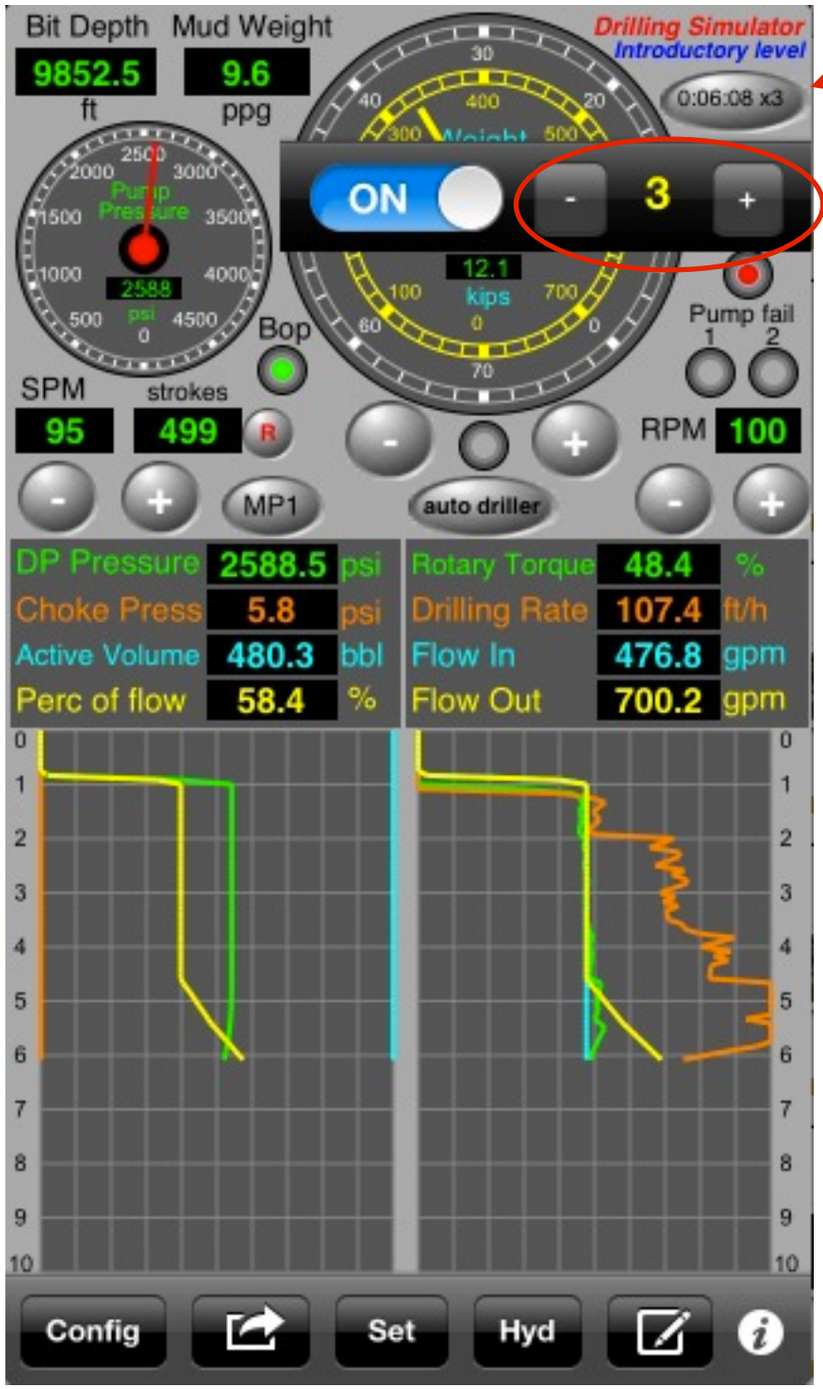
Manometer:

Always shows the pump pressure of the mud pumps #1 and #2 in parallel.

Booster Line (Mud Pump #3):

The pump pressure and pressure losses in booster line are not shown in this application.

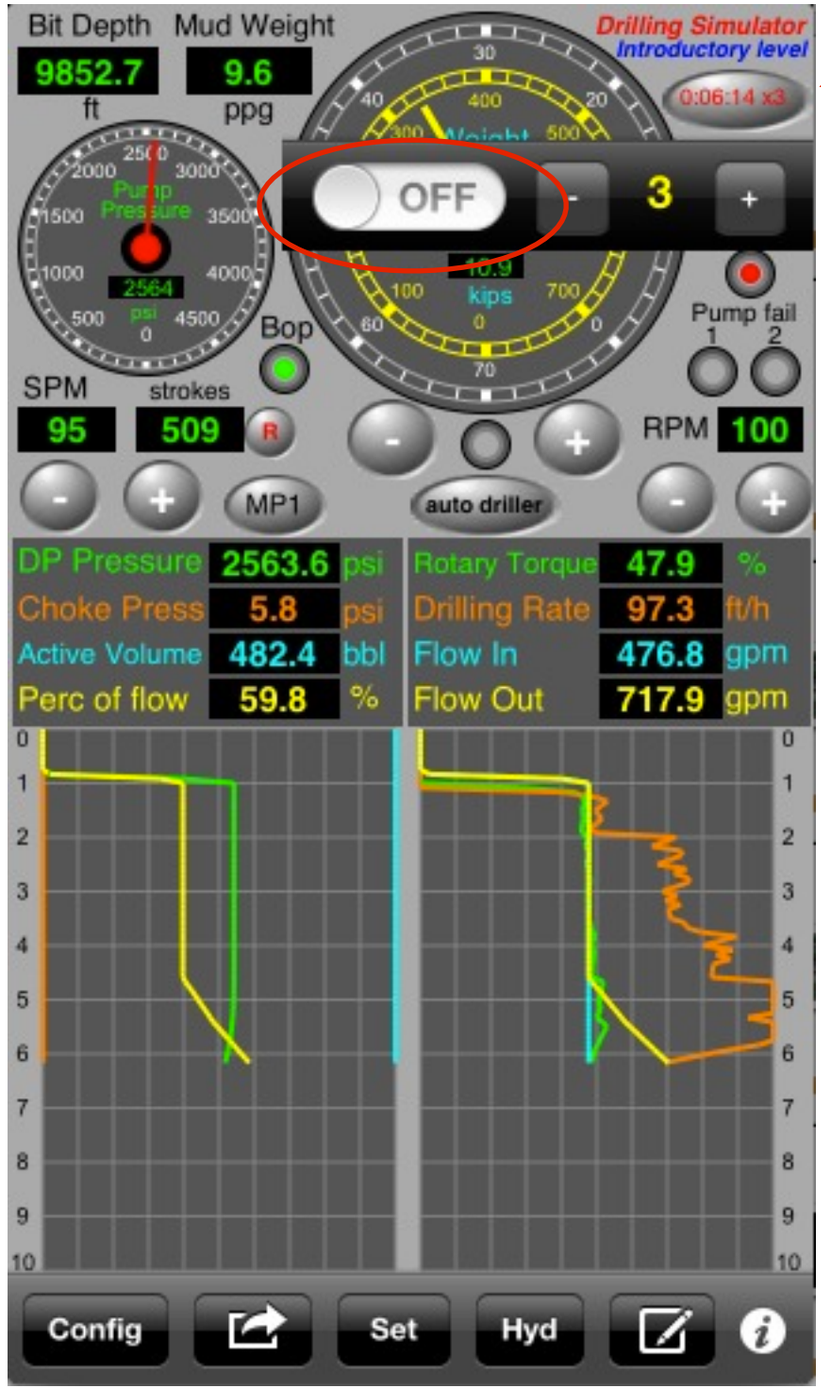
Tap on “**Timer**” button to Pause and Set X times



Normal operation:
Black color

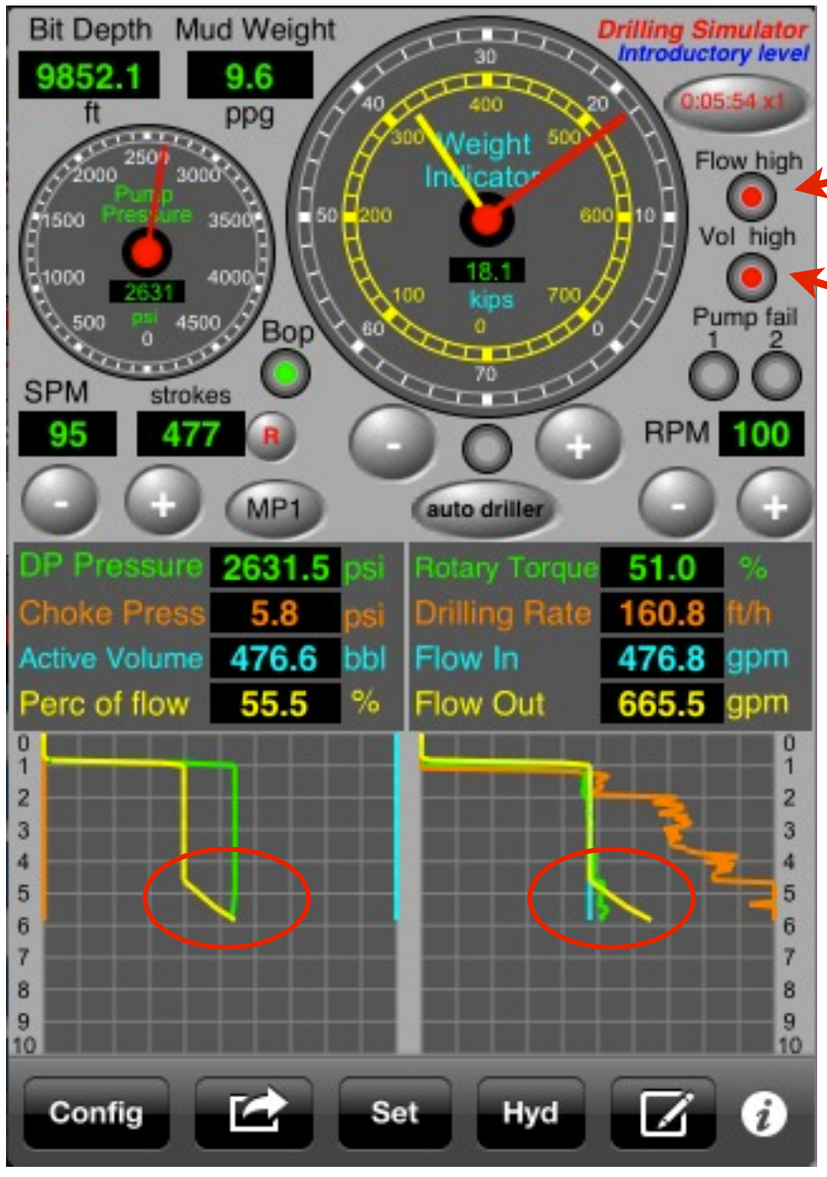
x times

Range: **1 to 9**



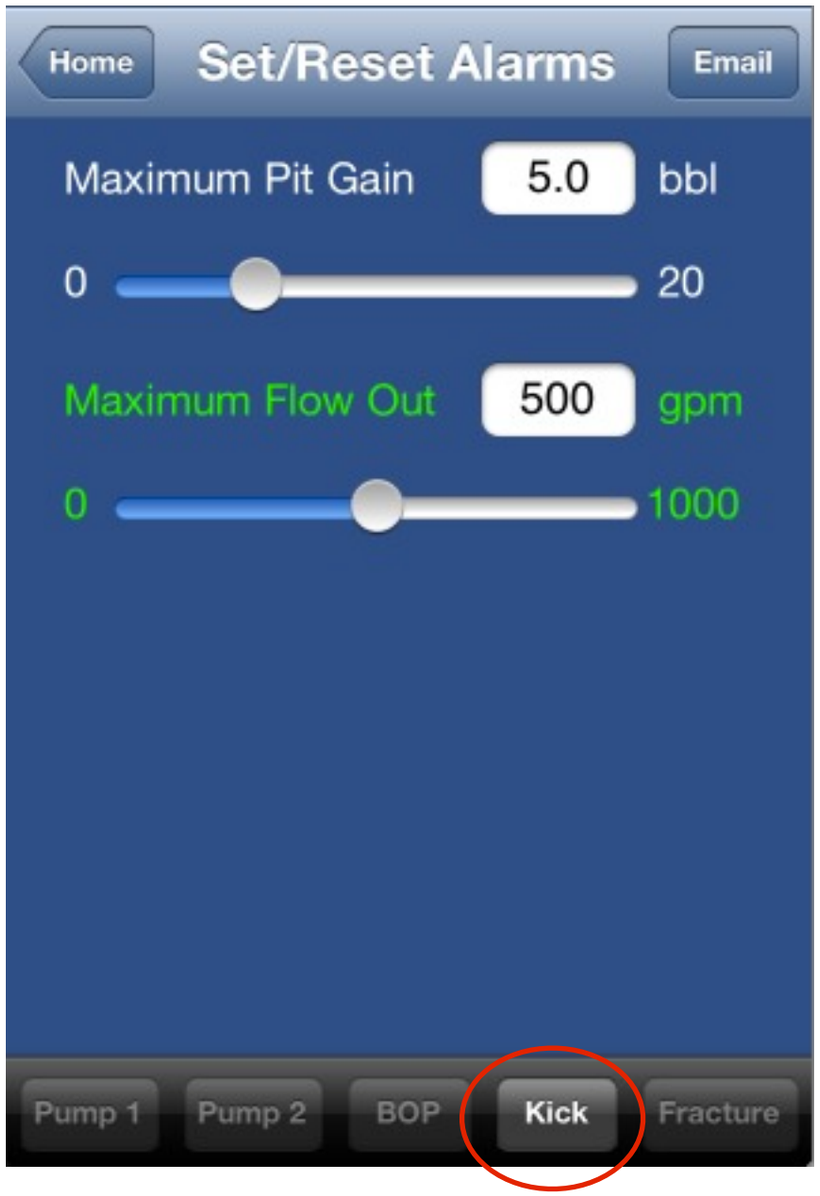
PAUSE:
Red color

Tap on "**Set**" button to set alarms for kick detection and to reset failure alarms like failure on mud pumps, bop or reset a kick



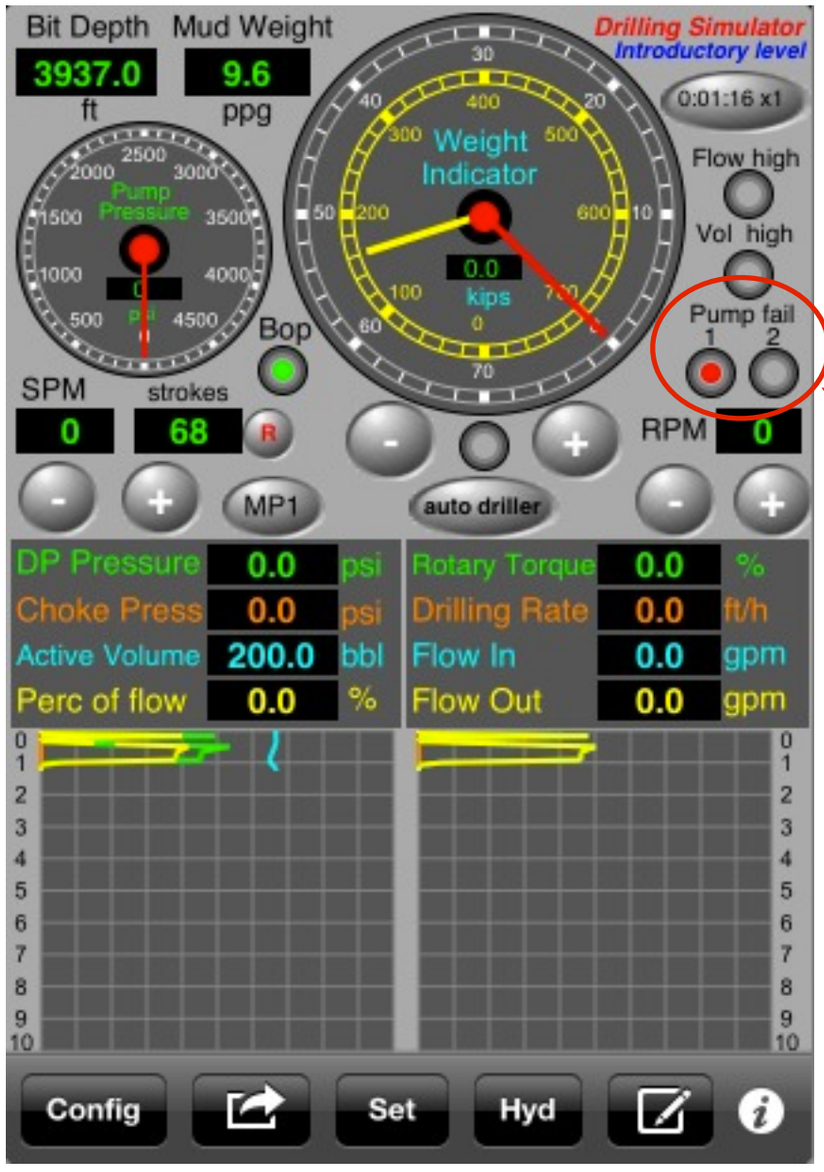
Increment of flow on the flow line > 500 gpm

Increment of volume on the mud pit > 5 bbl

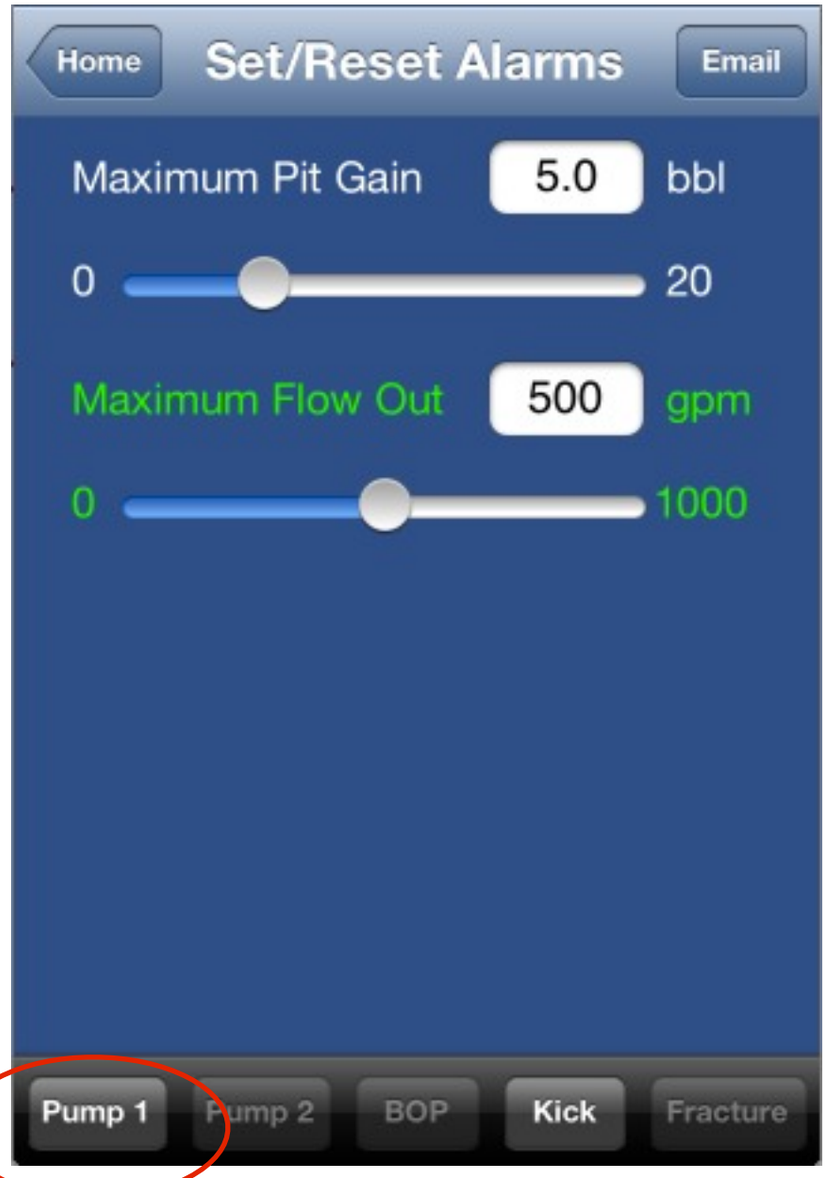


Reset Kick

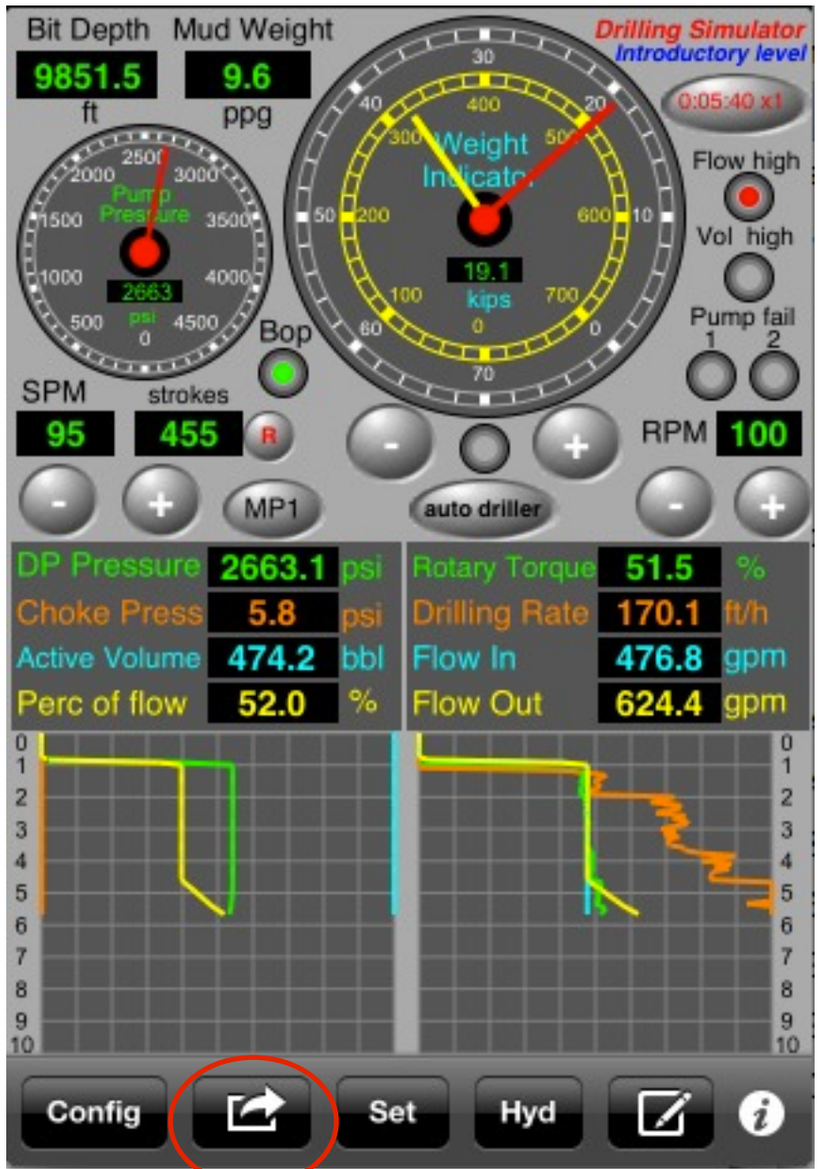
Tap on “**Set**” button to set alarms for kick detection and to reset failure alarms like failure on mud pumps, bop or reset a kick



failure on
mud pump #1



Tap on “**Pump 1**” button to
reset failure on mud pump #1



Tap on "**Options**" button

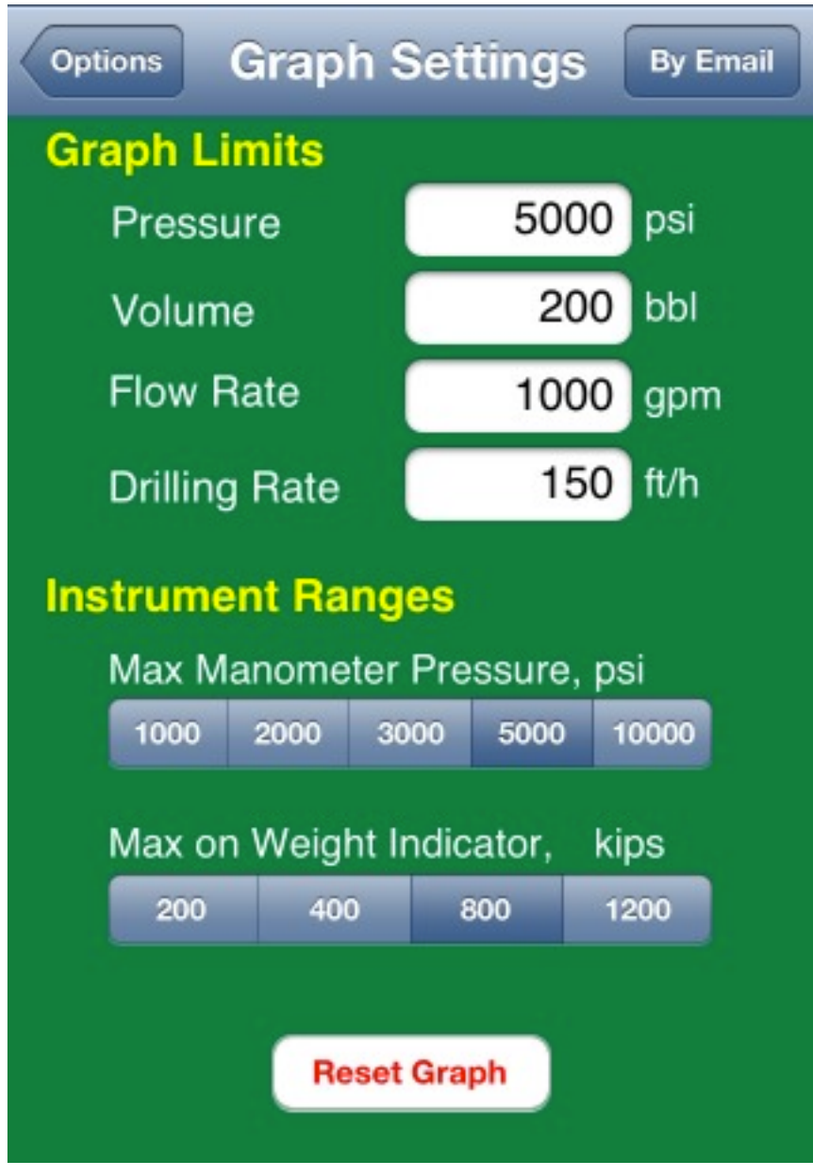
on toolbar and tap on "Graph Settings" button to set the maximum values for the geolograph

The graph shows 10 min on graph.

With iPhone on horizontal position, only iPhone 5 / iPod Touch 5 th gen.

Graph Historical:

This app works with the last 120 min of simulation. After 120 min, occurs a shift from begin.



Reset Graph:

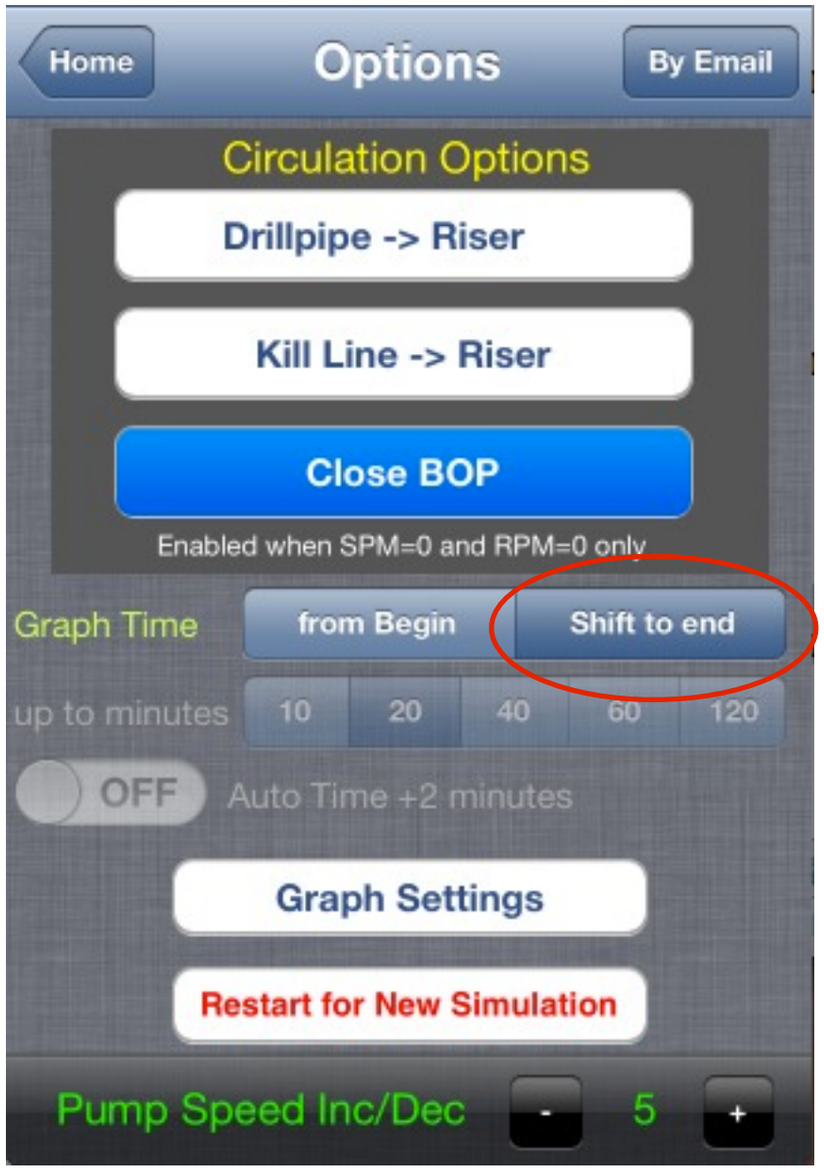
Tap on "Reset Graph" button to reset just the graph.

Instrument Ranges:

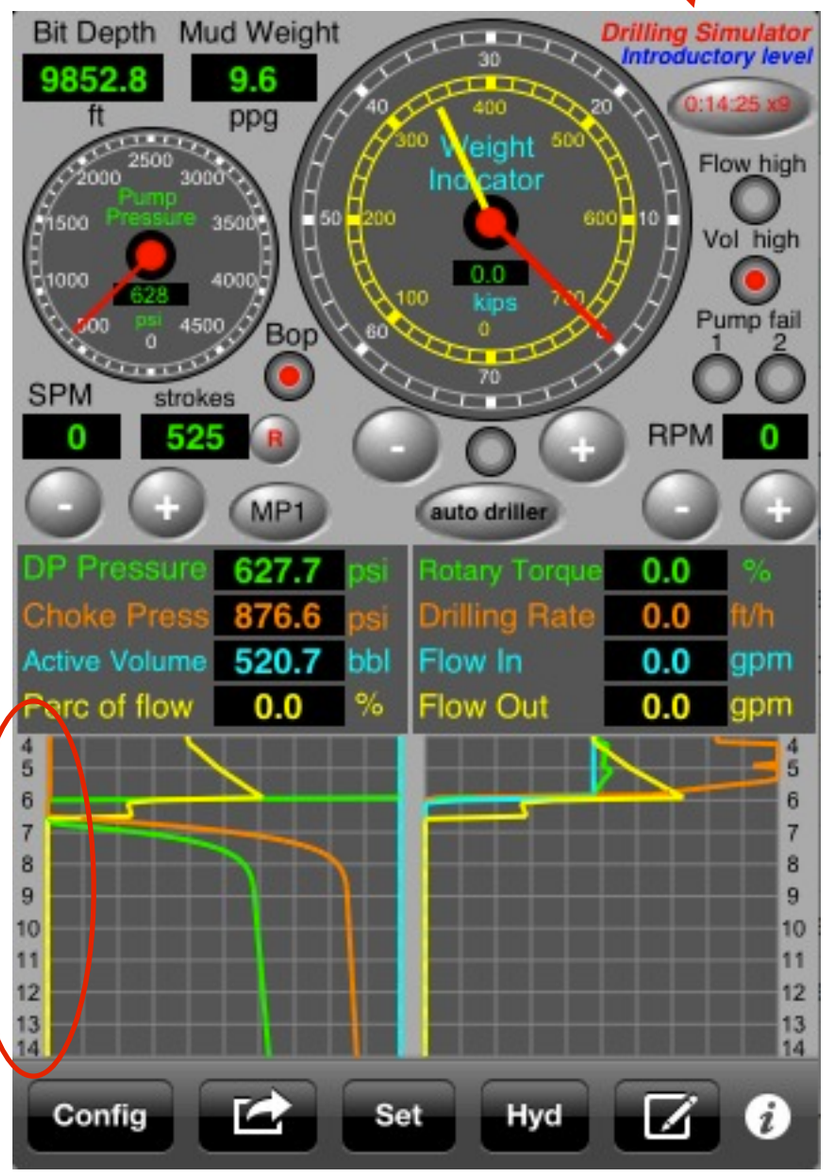
Set "Maximum Manometer Pressure" and "Maximum value on Weight Indicator"

The “**Shift to End**” graph time option:

timer: 14 min

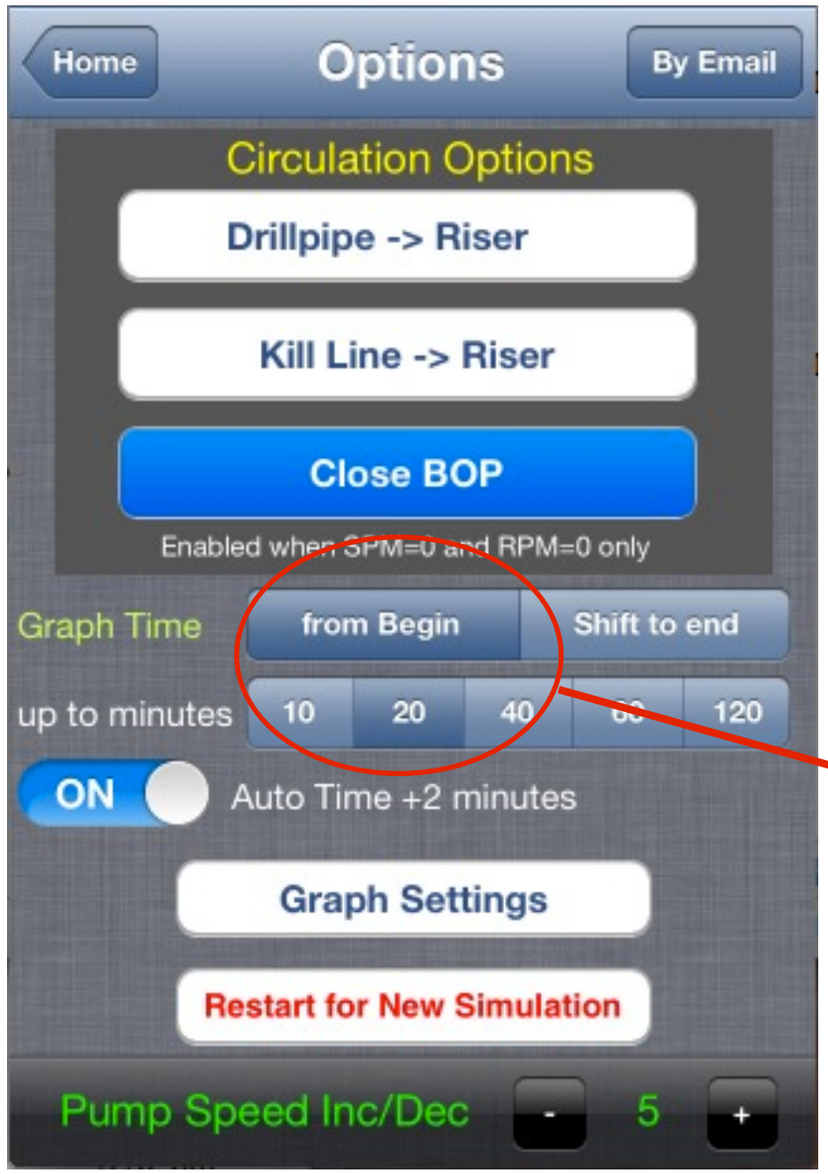


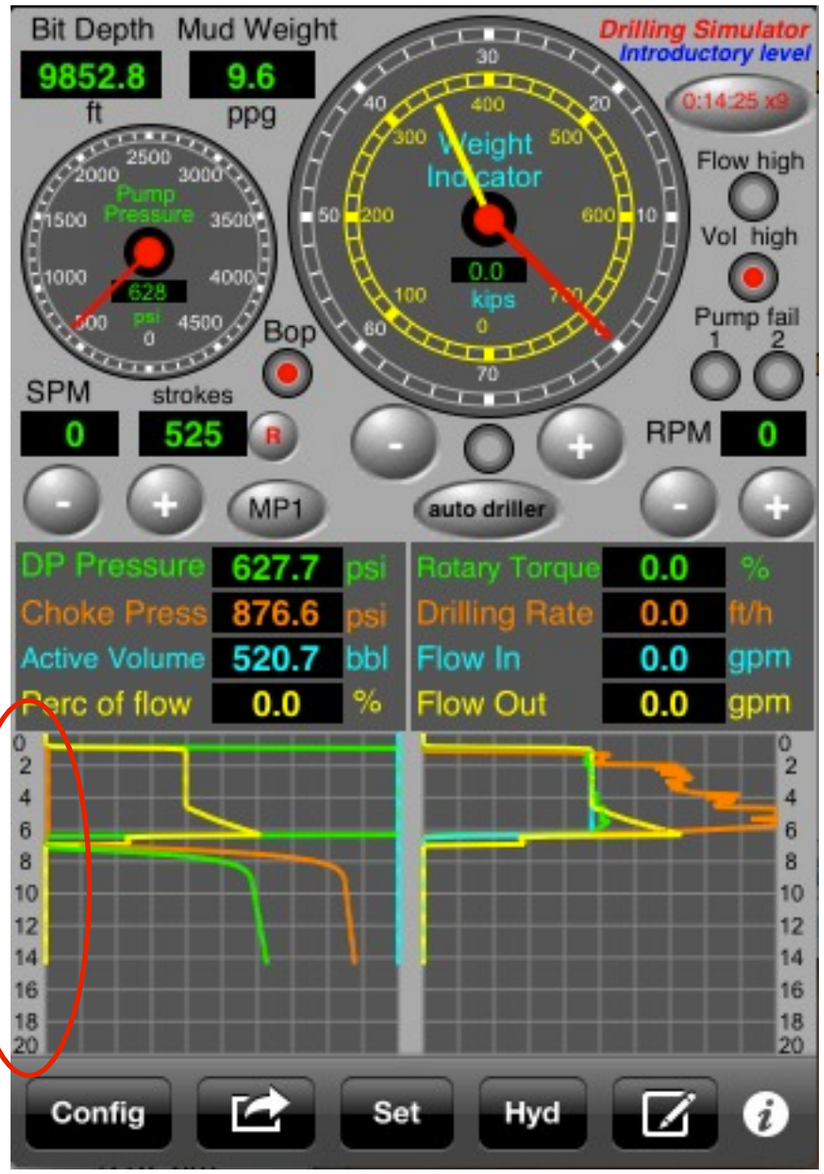
interval:
4 to 14 min



For a interval > 10 min of simulation, select time on Graph to "**from Begin**" to 10, 20, 40, 60 or 120 min

to **20** min selected





Auto time:

Set this switch to **ON** to set a automatic increment of 2 min on graph.
It is enabled only when **Time** is selected "**from Begin**".

Set the instruments scale for **Pump Pressure Manometer** and **Weight Indicator**

Example:

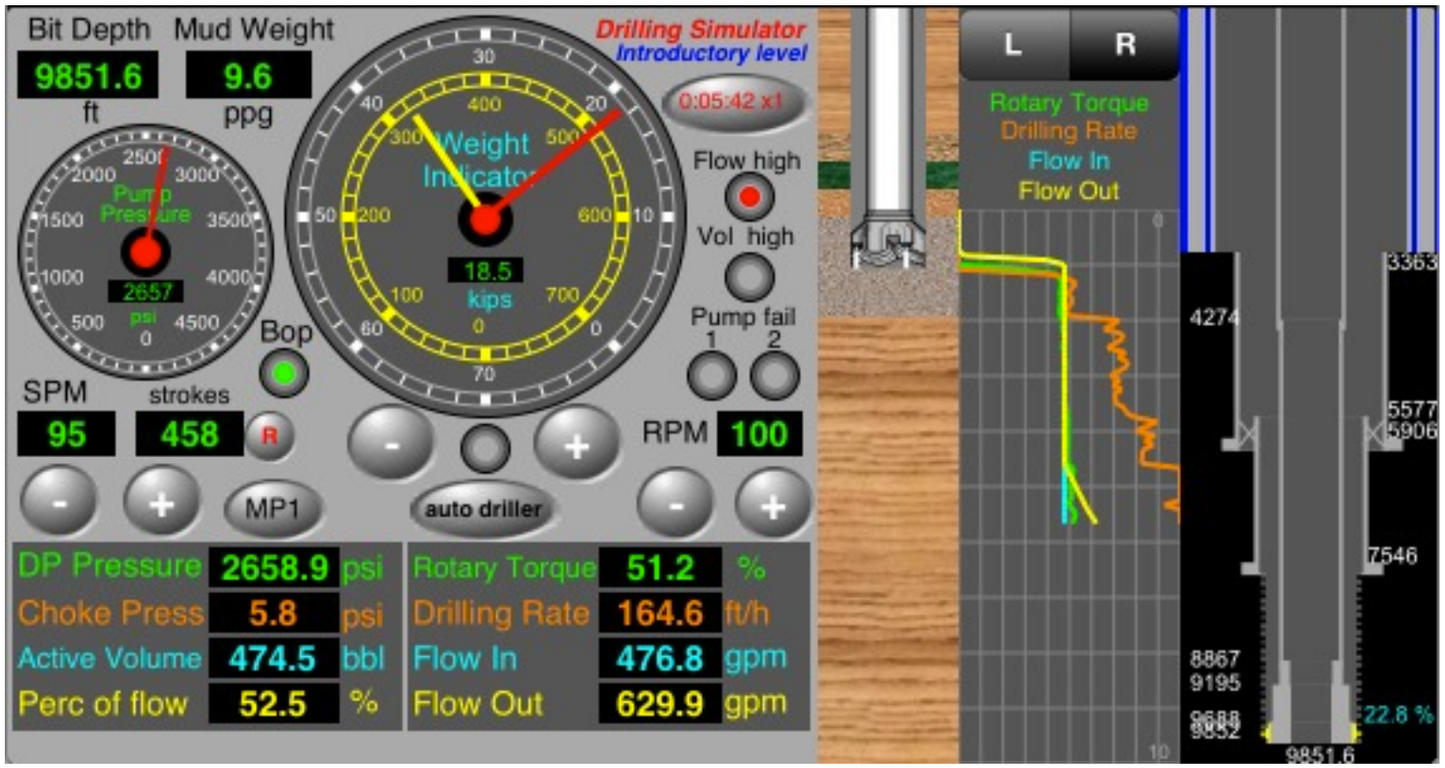
Manometer: 0 to **3000** psi

Weight Indicator: 0 to **400** kips

Example:

Manometer: 0 to **5000** psi

Weight Indicator: 0 to **800** kips



Moving the Drill String

Auto Driller

Hydraulics and Neutral Line

Kick Detection

Shut-in the Well

Stabilization of the Pressures

Save on iCloud

Importing by WC Simulator for iPhone

Importing by WC Simulator for iPad

The Driller’s Method (on iPhone)

The Wait and Weight Method (on iPhone)

The Driller’s Method (on iPad)

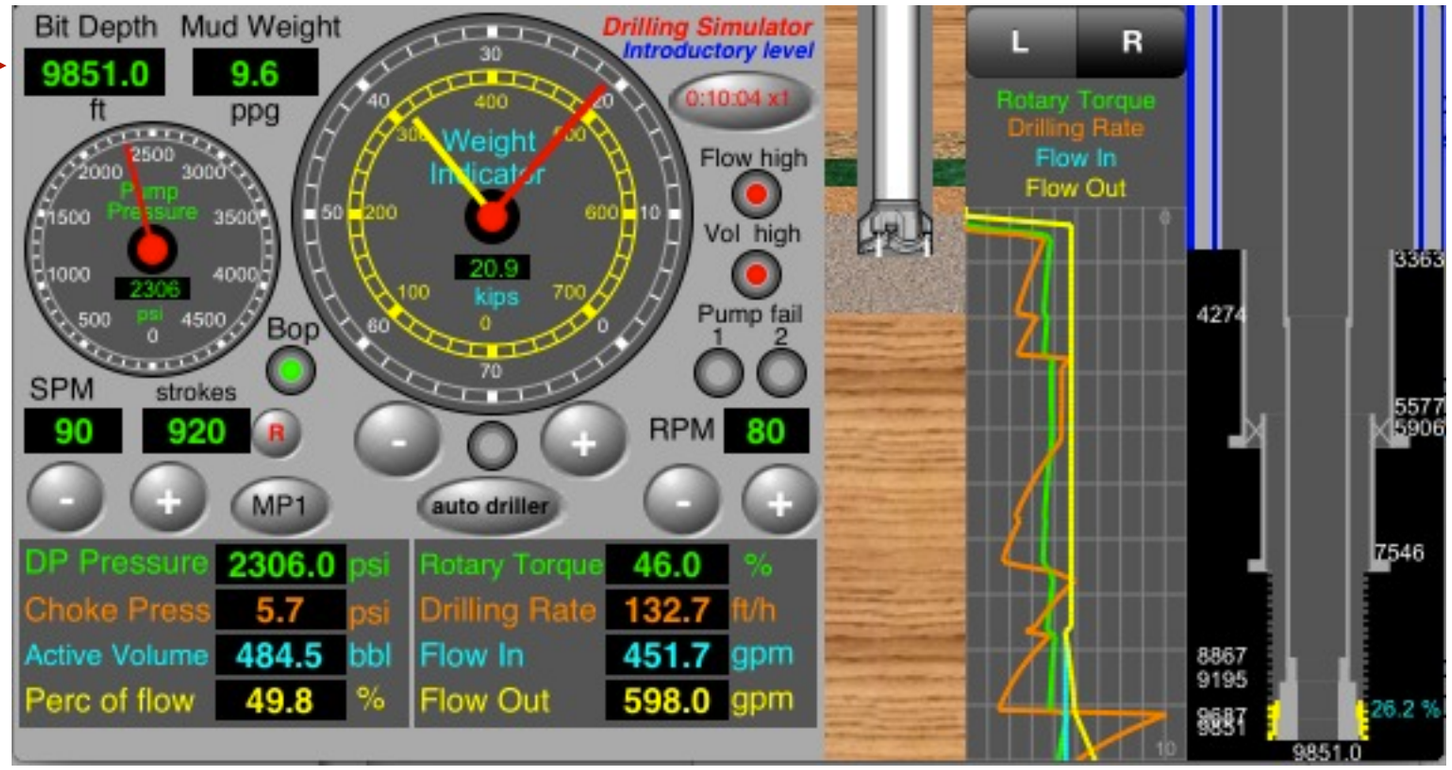
The Wait and Weight Method (on iPad)

Fracture on Shoe Depth

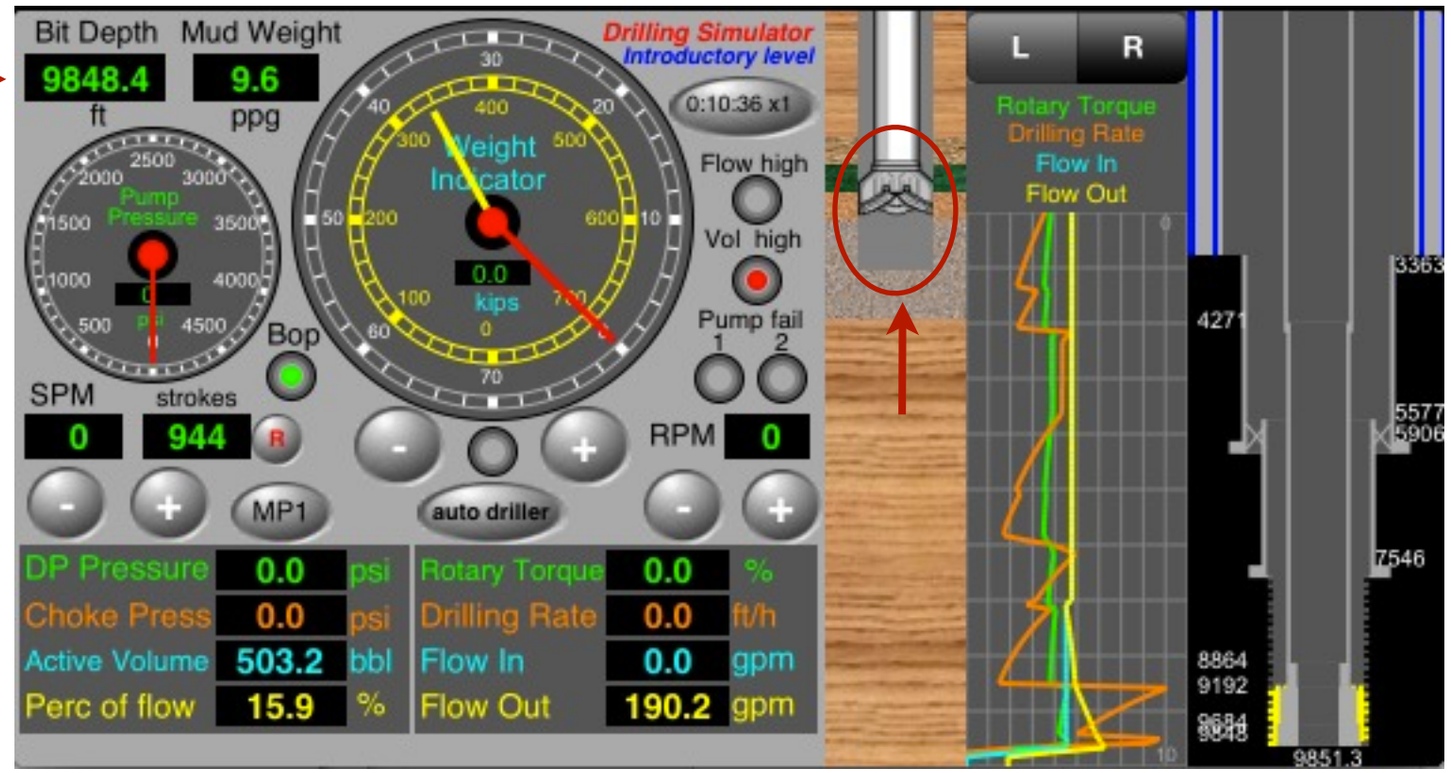
Underground Blowout

Blowout

Use the button [+] to move down the drill string. When the drill bit reaches on the bottom hole, the WOB (weight on bit) increases.



Use the button [-] to decrement the WOB. When WOB = 0, the drill string is moved to up (off the bottom)

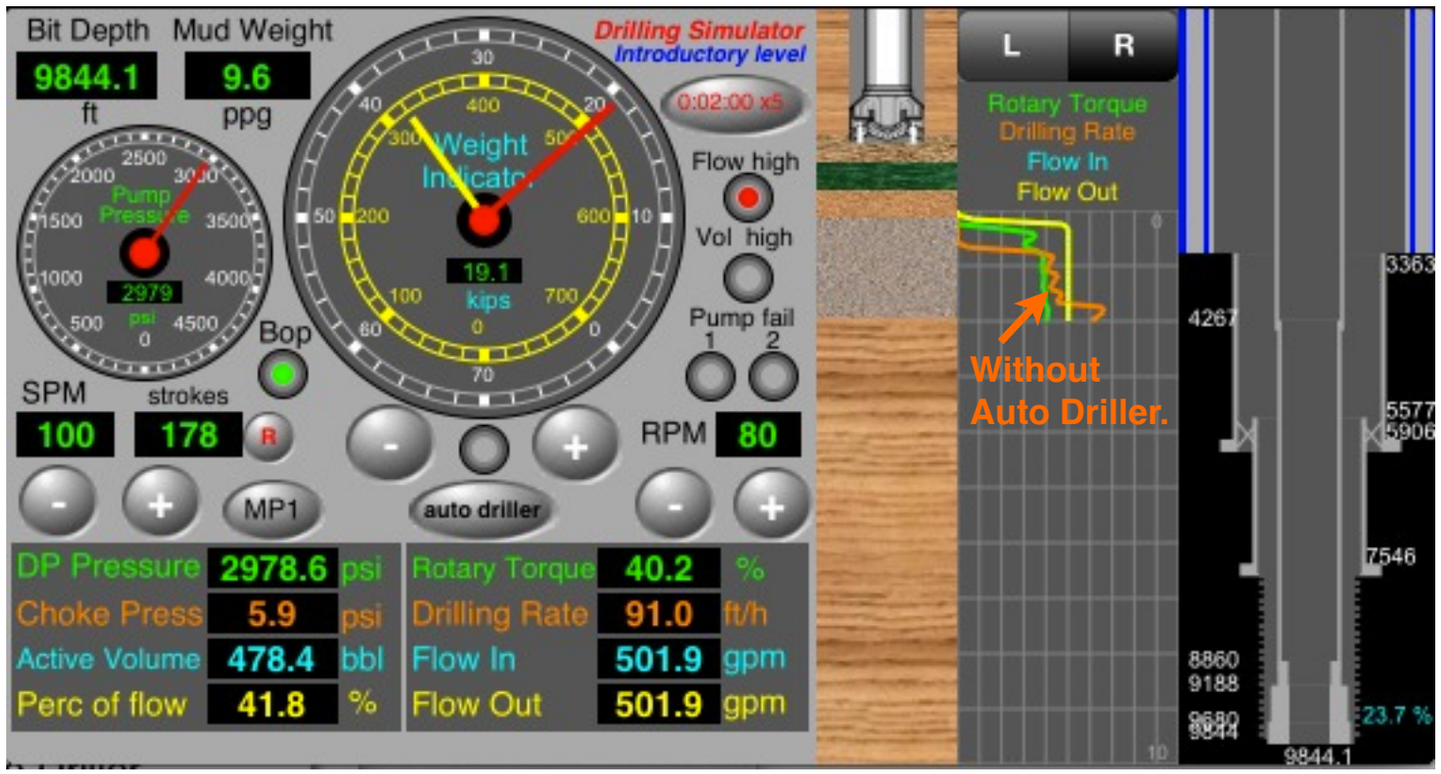


Auto Driller:

Tap on “**auto driller**” button to activate or desactivate it.

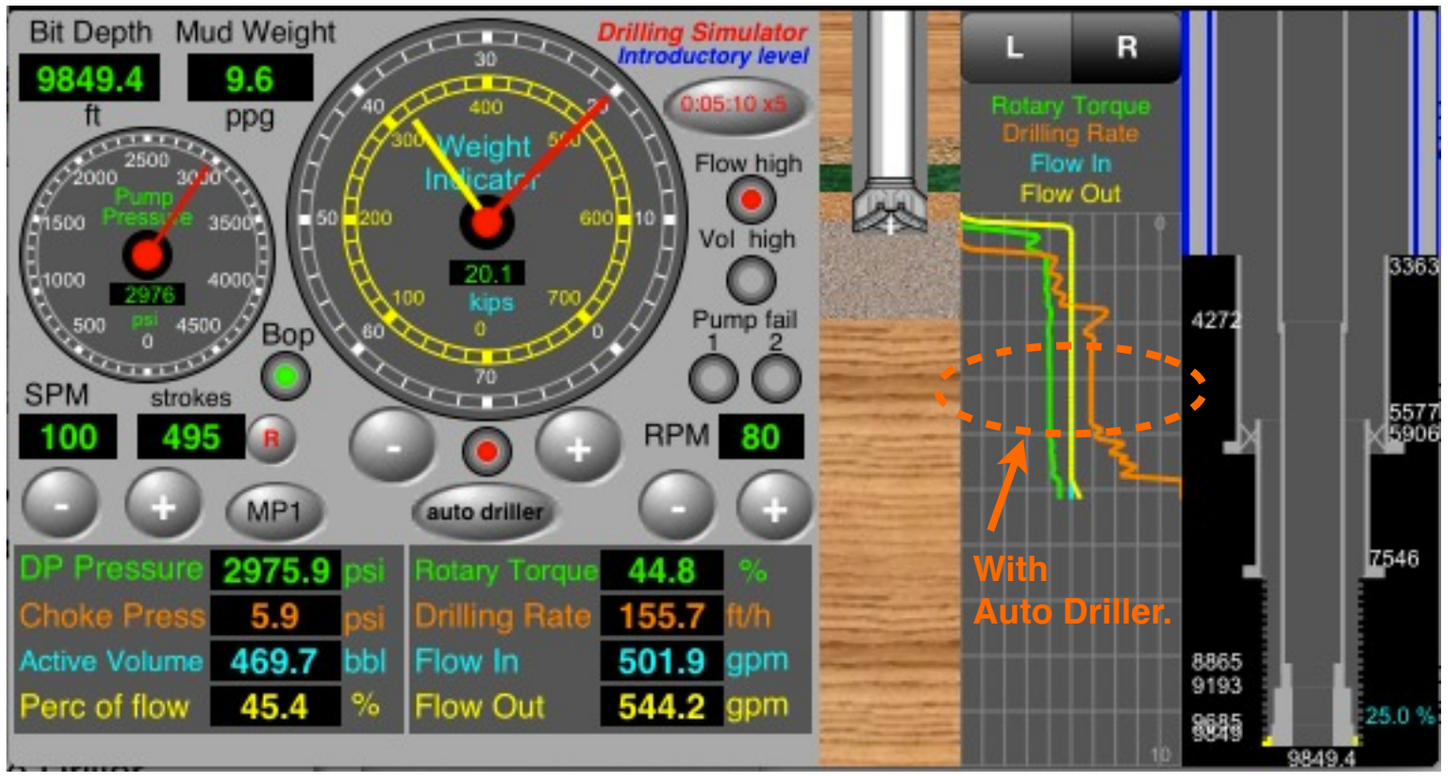
Without:

It is necessary to tap on buttons - / + to maintain the **WOB** (weight on bit).



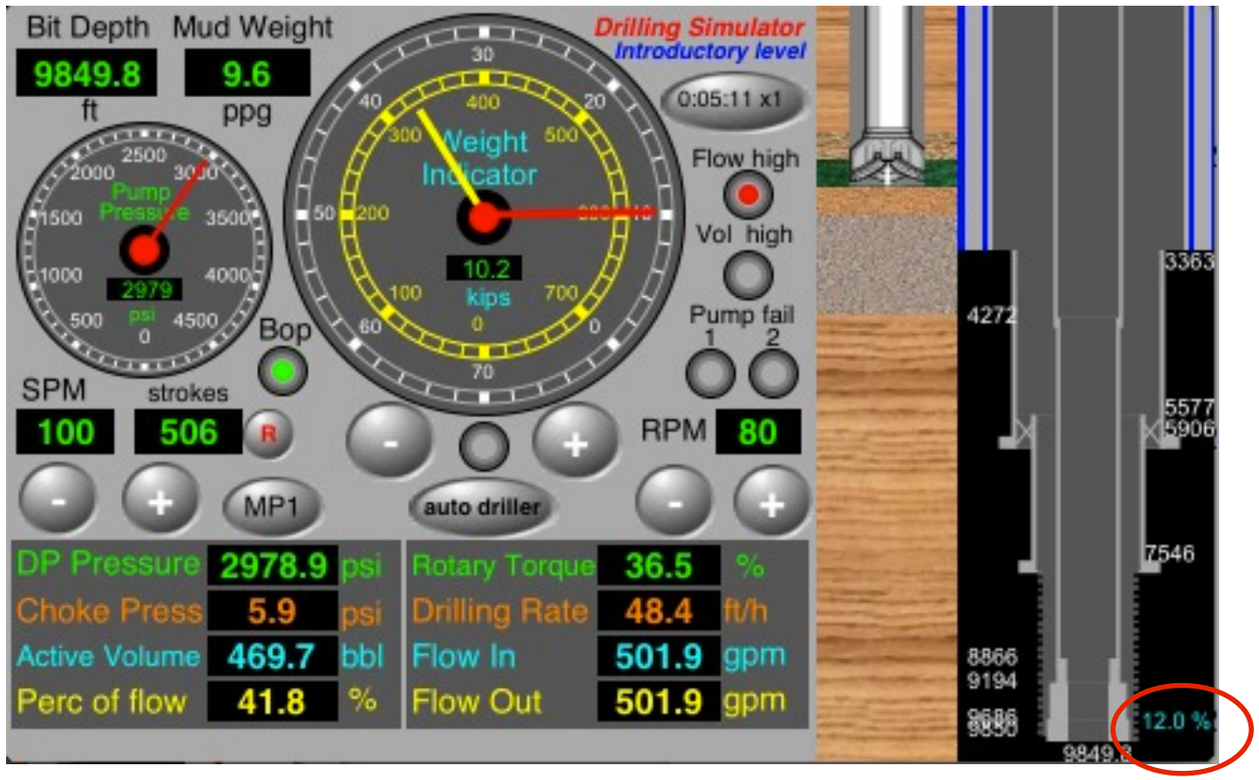
With:

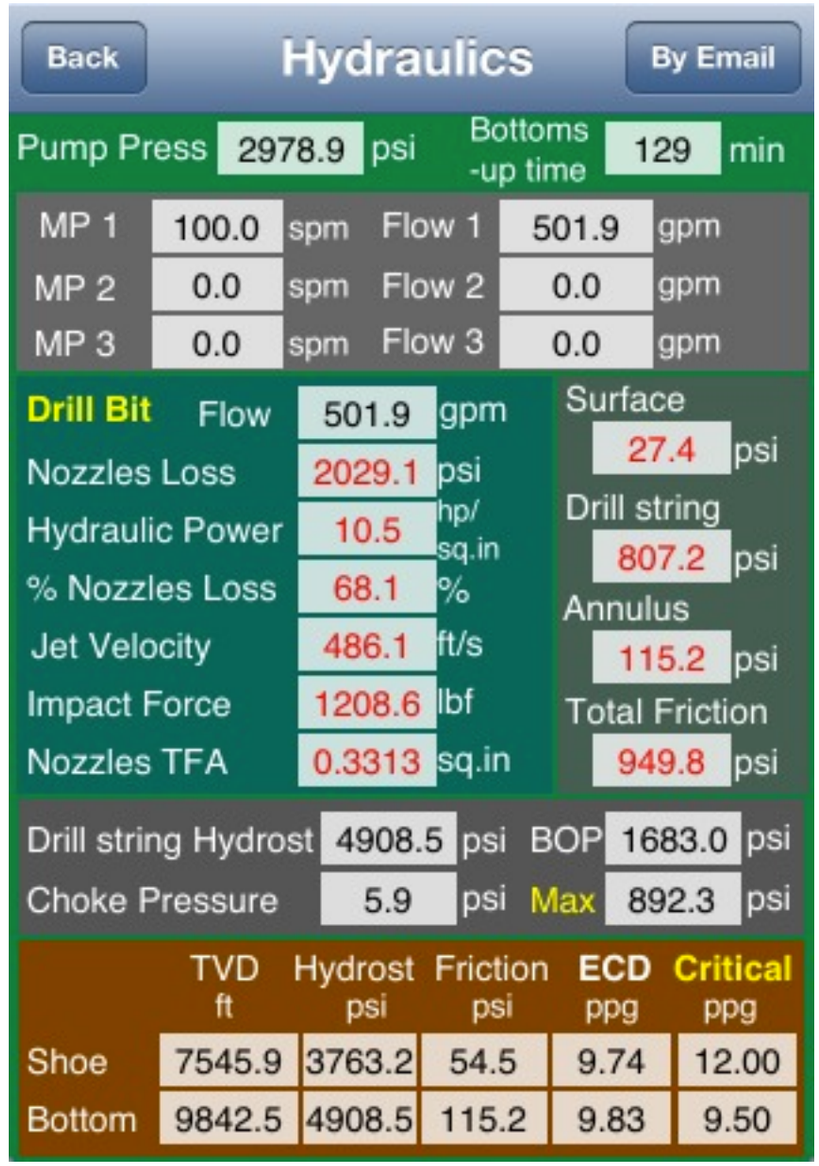
The **WOB** (weight on bit) is constant.
It changes automatically to Off if to tap on the buttons - / +



Tap on "**Hyd**" button to show the Hydraulics View.

- Mud Pumps Informations
- Bottoms-up time
- Drill bit parameters
- System friction losses
- Hydrostatics and Critical Pressure on choke and BOP
- ECD on shoe depth and bottom hole
- Show critical density on shoe (fracture) and the bottom (influx)

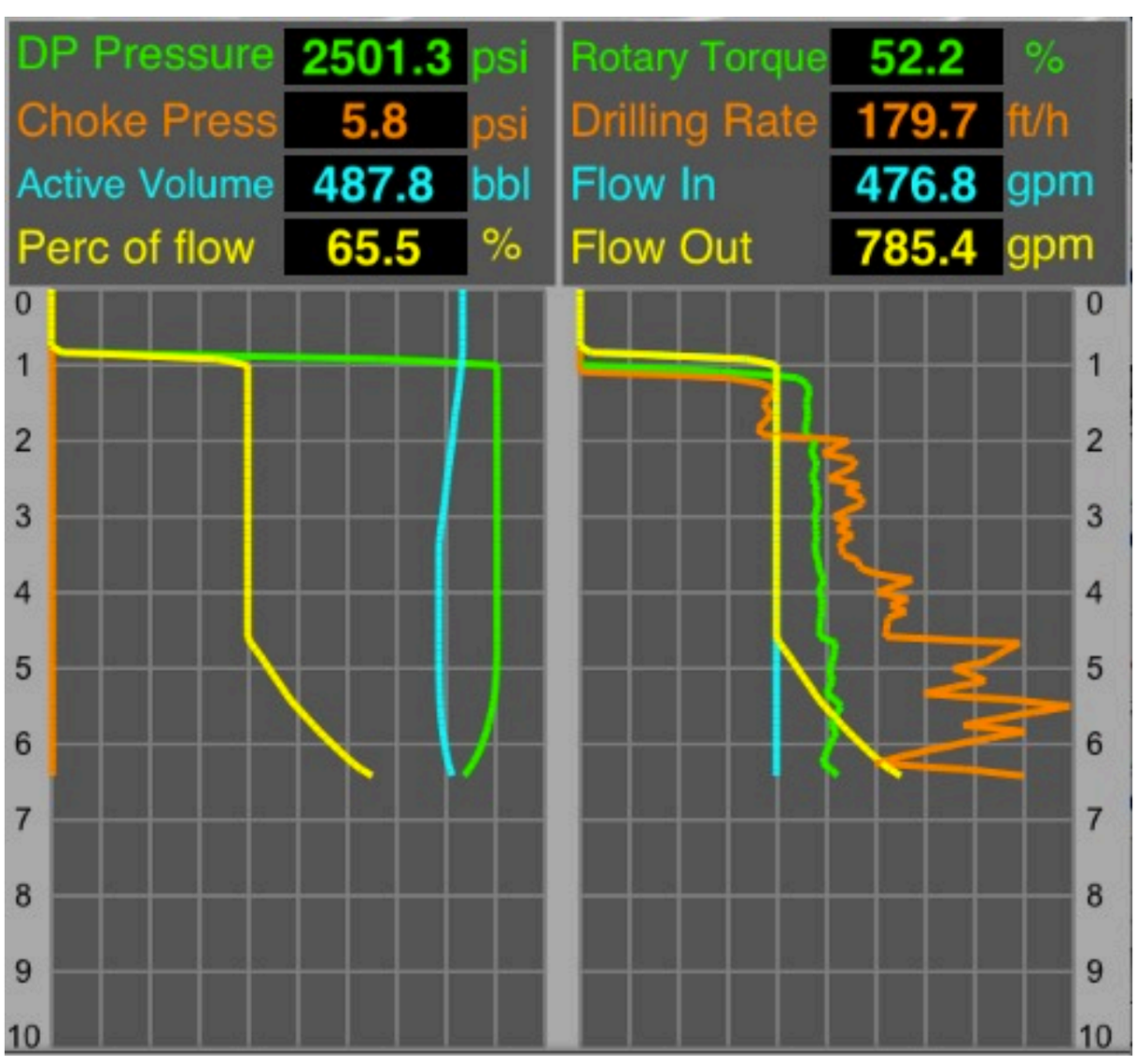


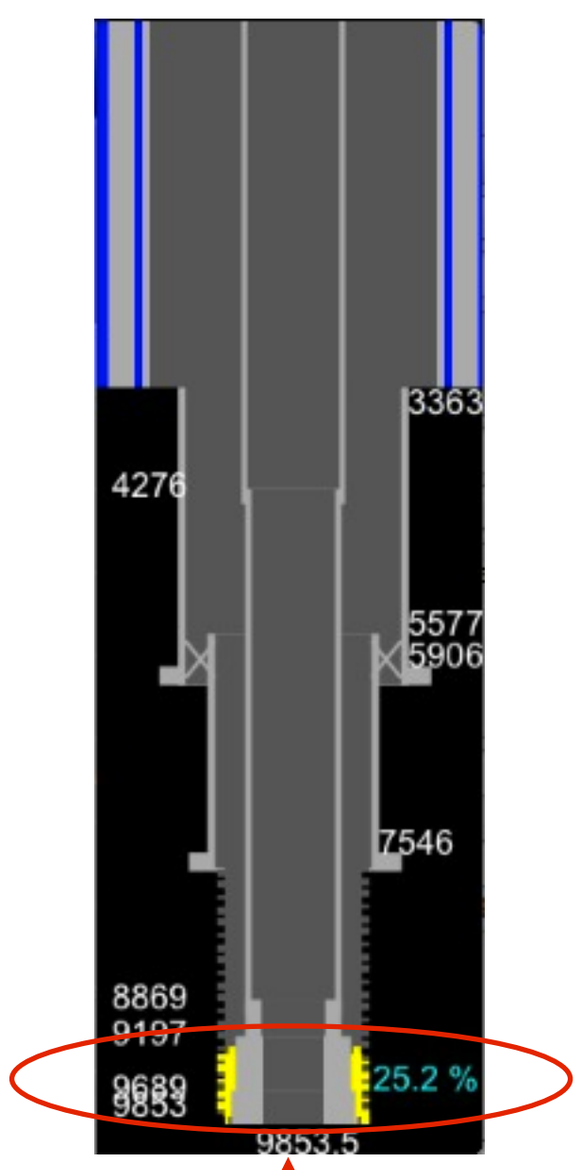


$$\text{Neutral Line} = \frac{\text{WOB -> length}}{\text{BHA -> total length}} \times 100$$

The following kick indications can be observed in the graph during the drilling:

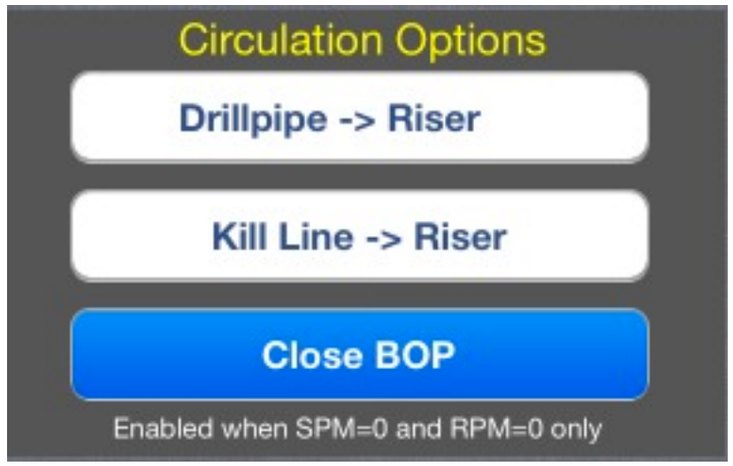
1- Decrease in the pump pressure
2- Increase in the pit volume (active tank)
3- Increase in the percent of flow
4- Increase in the rotary torque
5- Increase in the drilling rate
6- Increase in the flow out

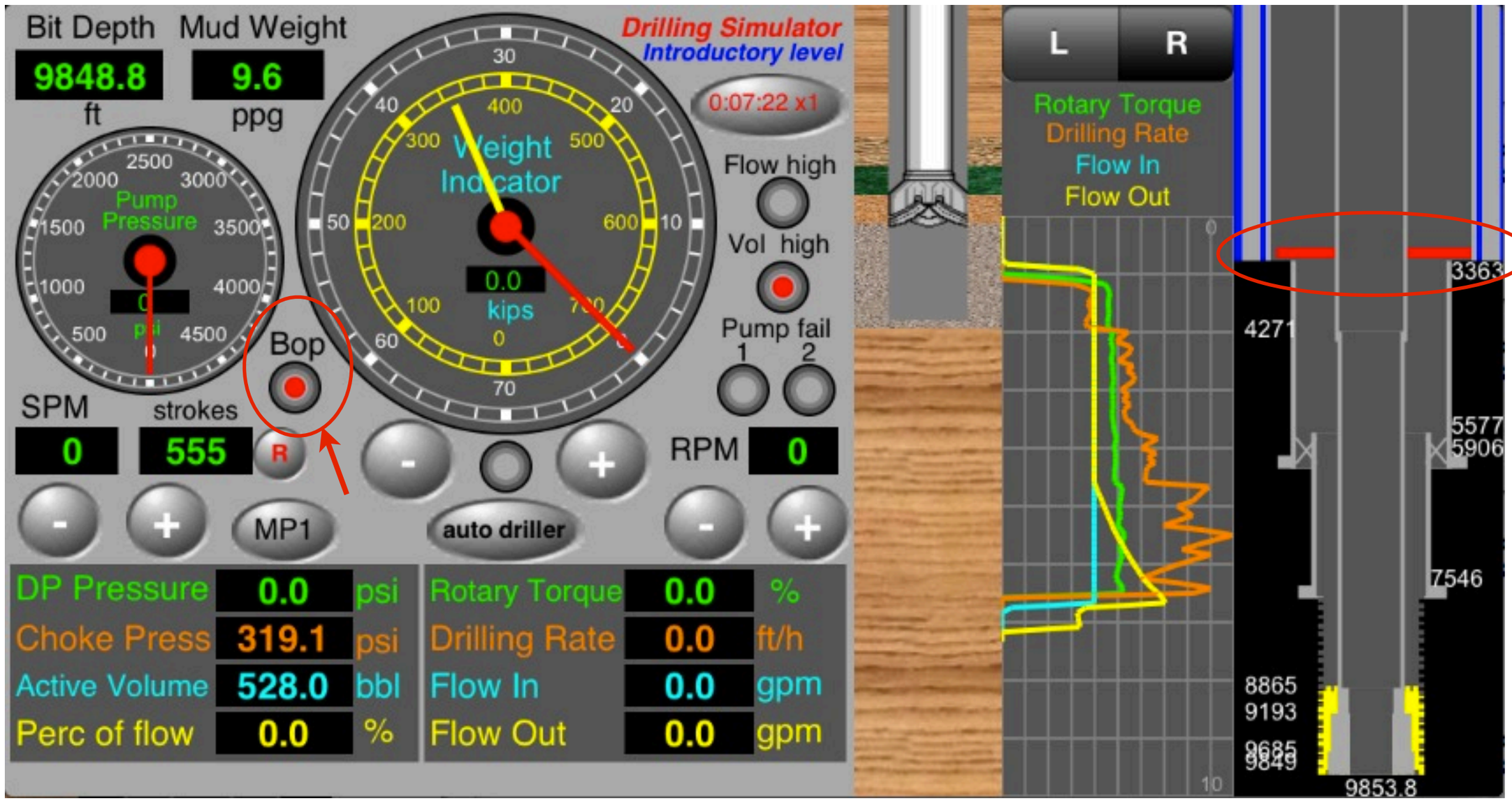




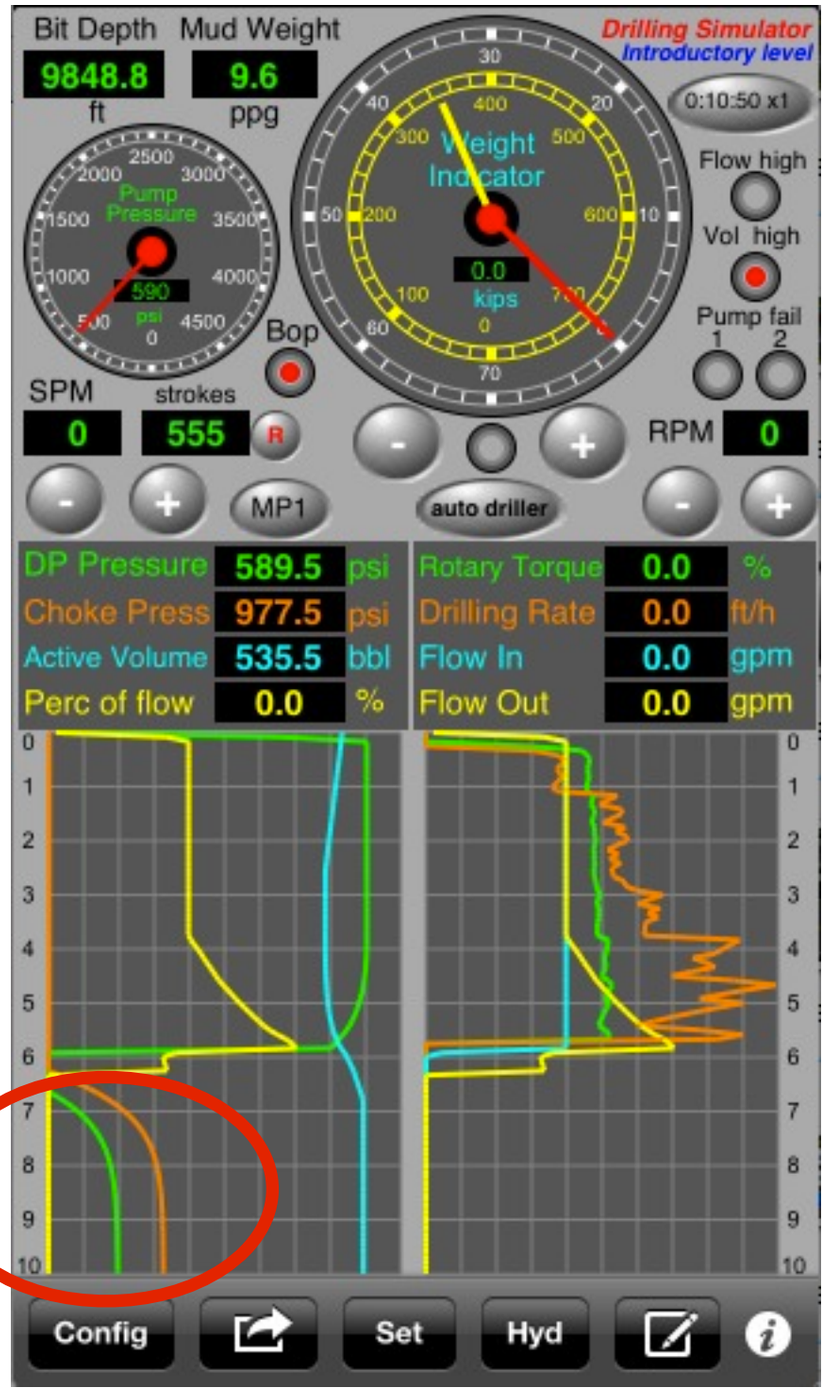
Visual indication with iPhone in horizontal position
(visible in simulation only)

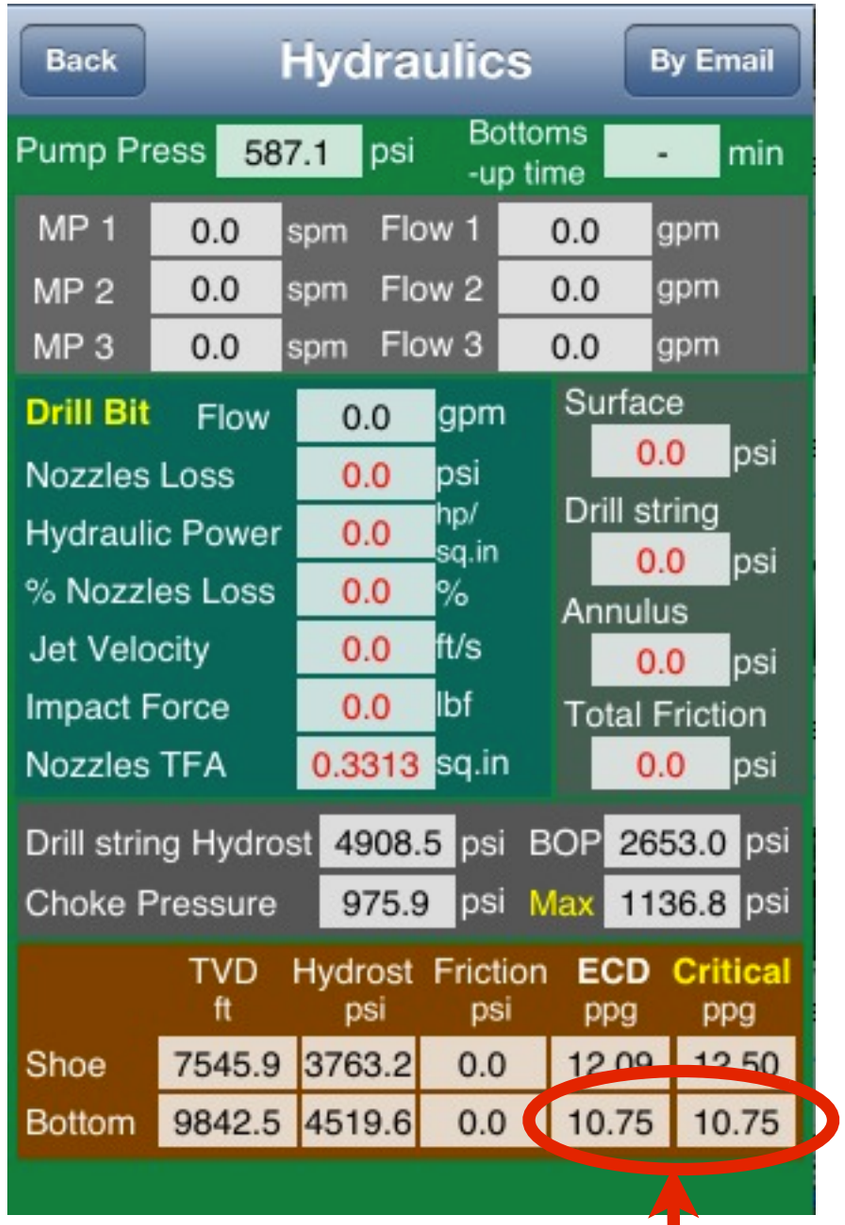
Set RPM=0, SPM=0, WOB=0 and Tap on “Options” button on toolbar and select “Close BOP” button:





Check for the behavoir of curves of DP pressure and Choke Pressure on graph. On hydraulics view ECD = Critical Density on Bottom:

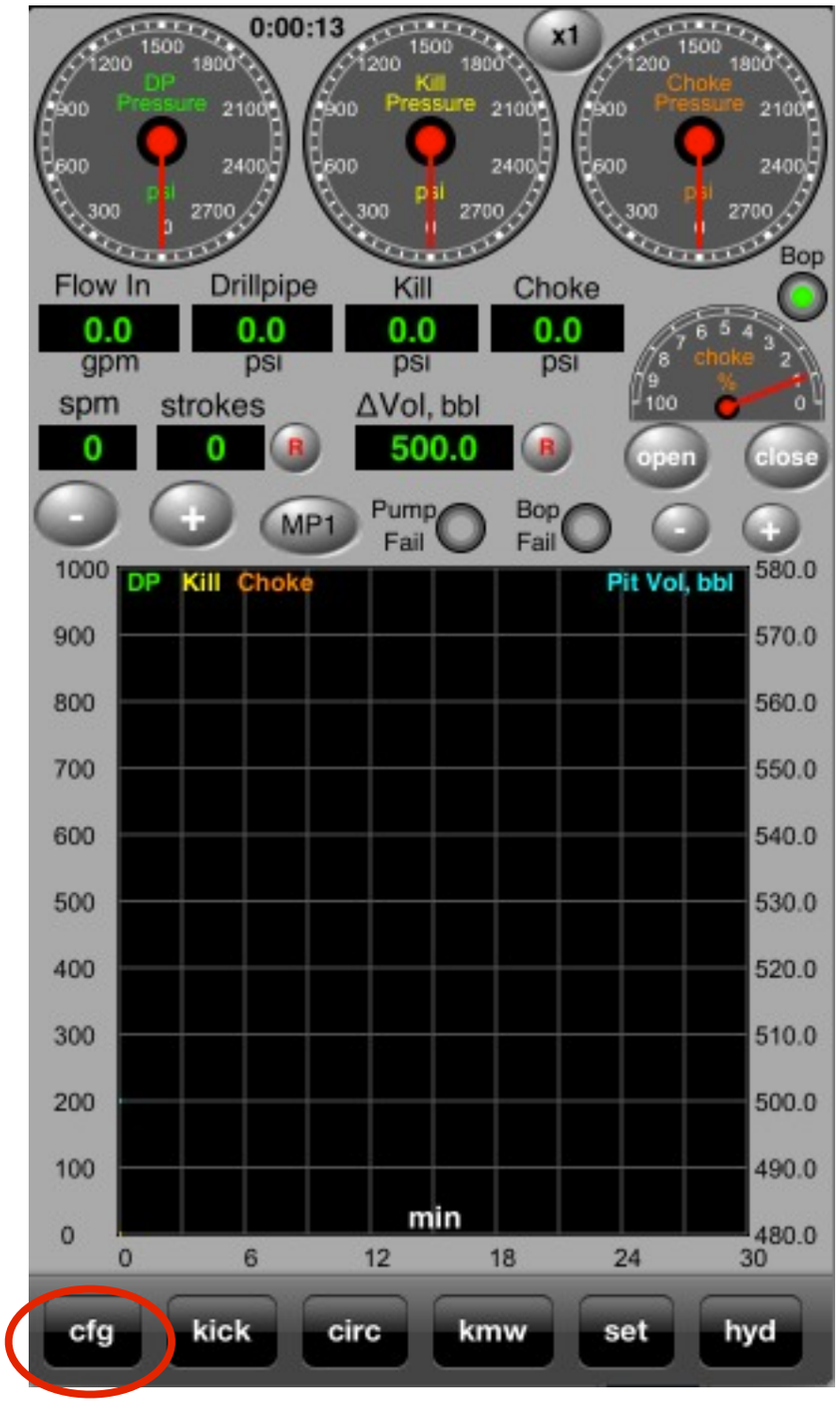




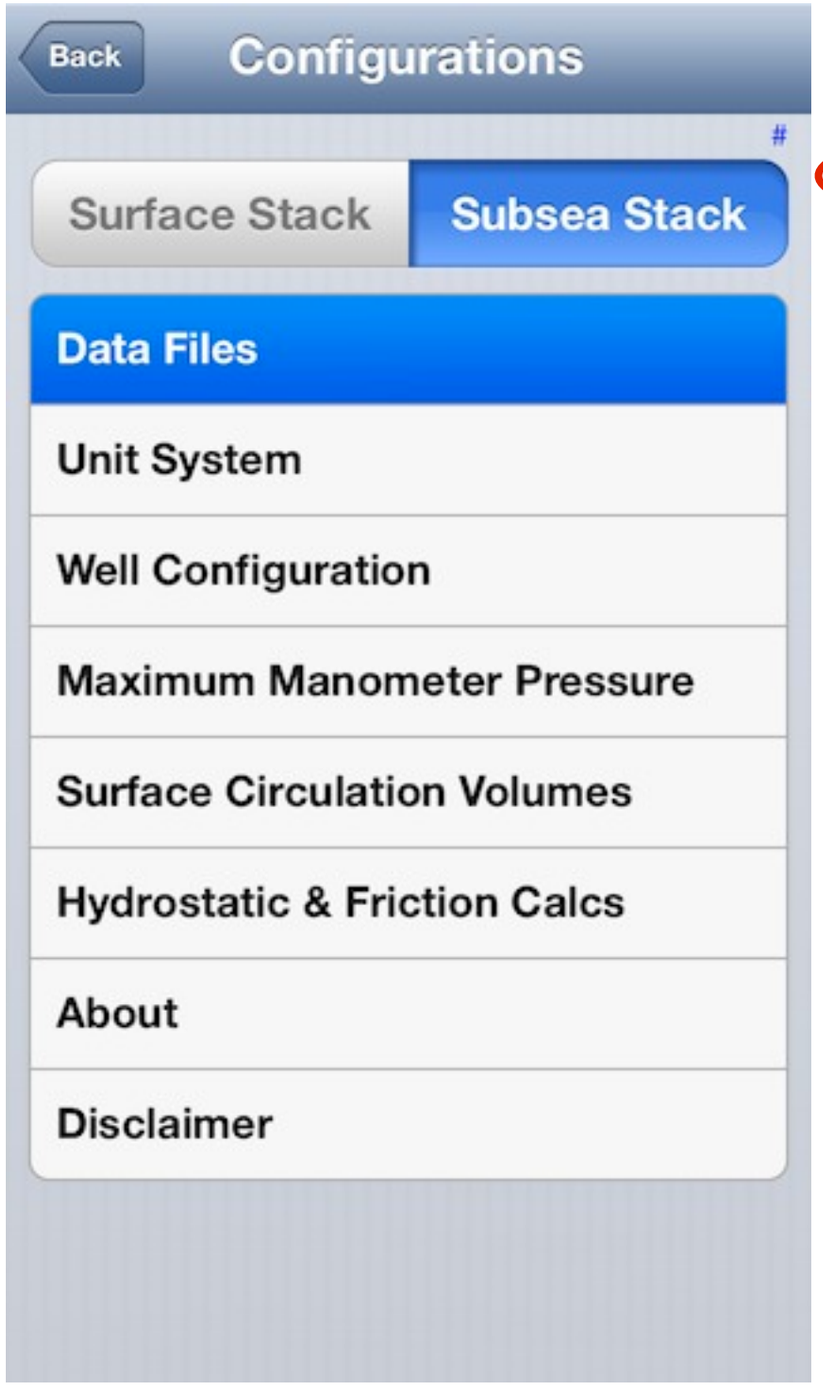
ECD = Critical Density on Bottom

Save after the stabilization of the pressures on iCloud to importing by the app "Well Control Simulation" for control.

Open the “Well Control Simulator” app to Import from “Drilling Simulator” to apply a Method to control.



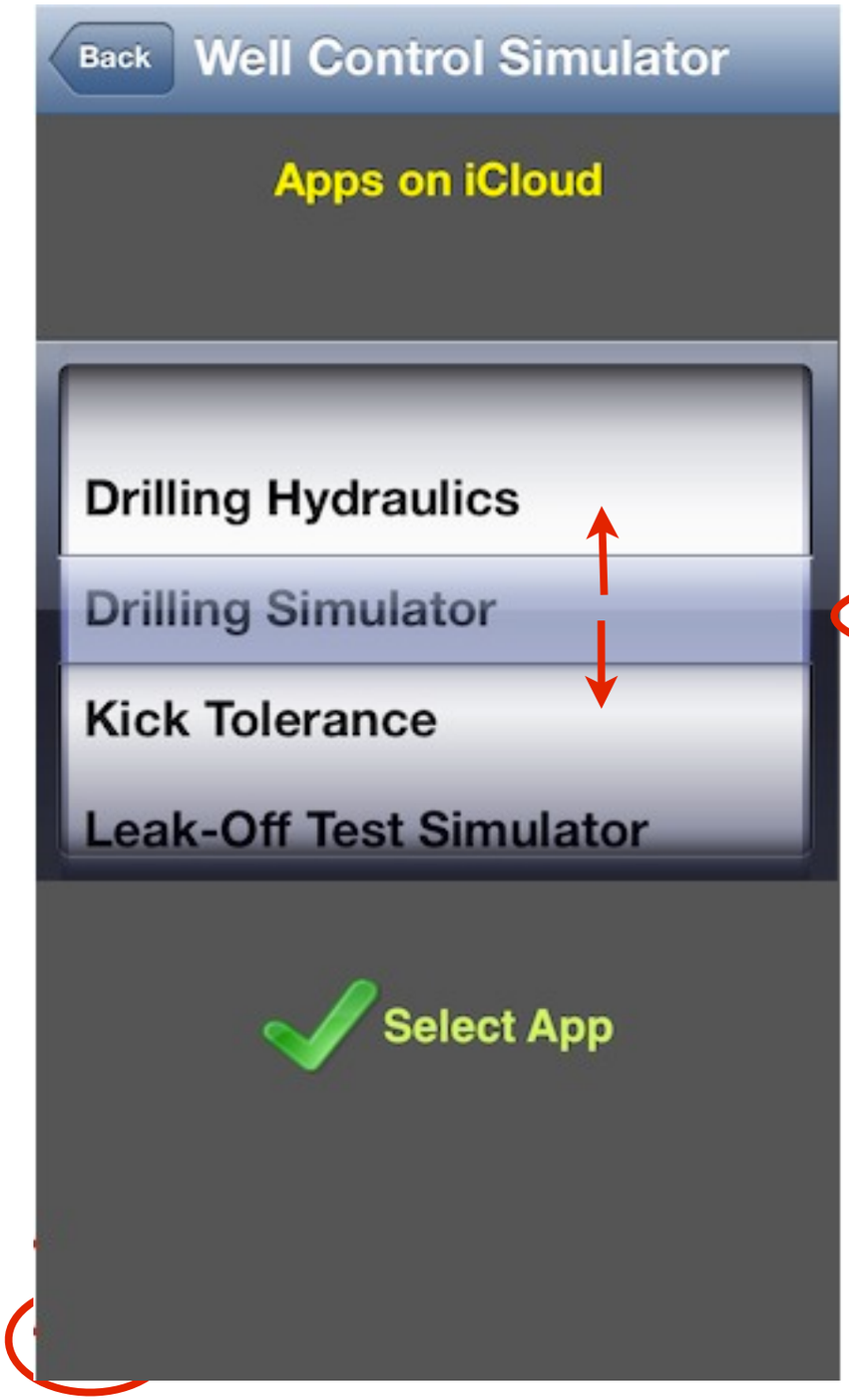
Tap on “**cfg**” button in Main View



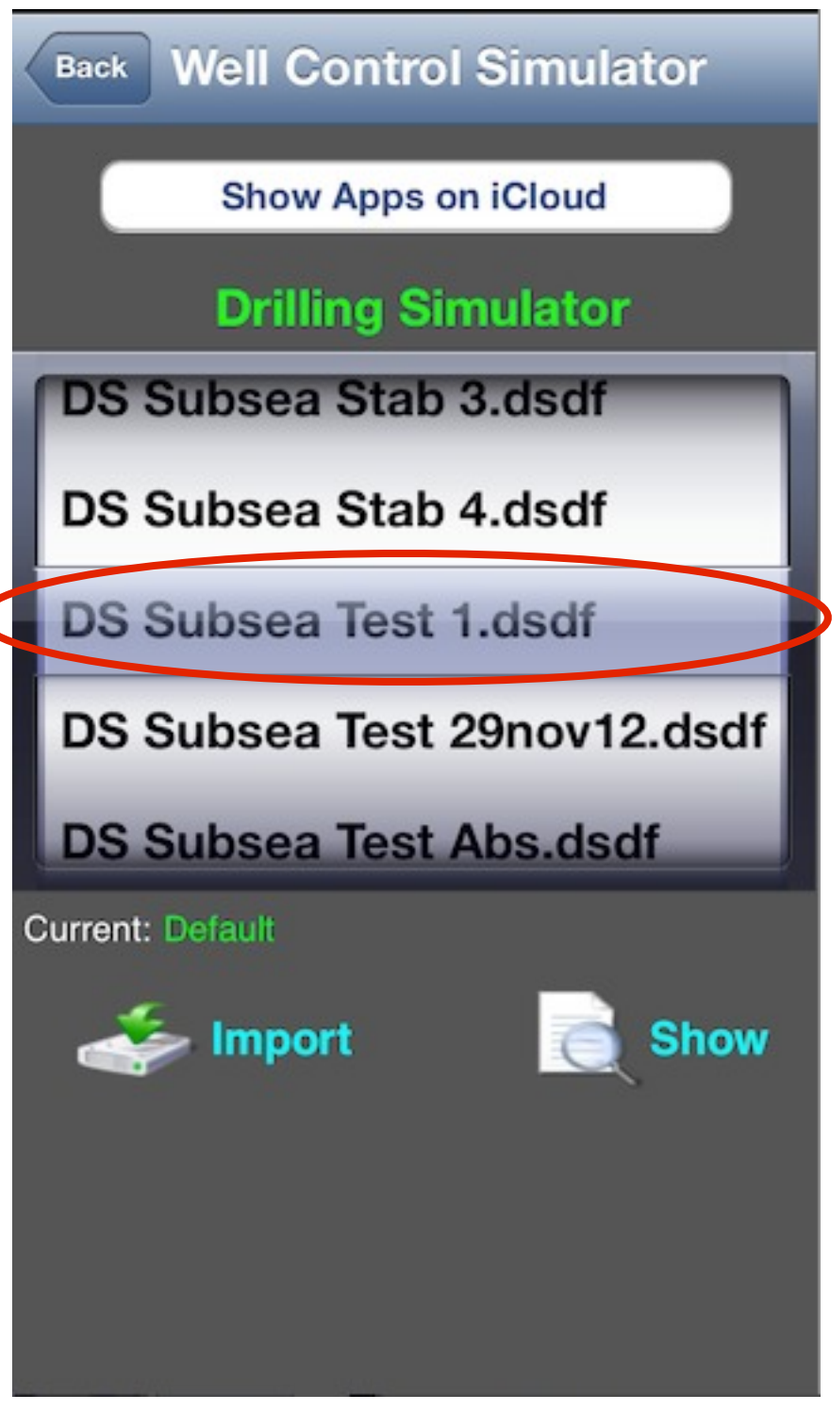
Select “**Data Files**”

Tap on “**Import from ...**” button

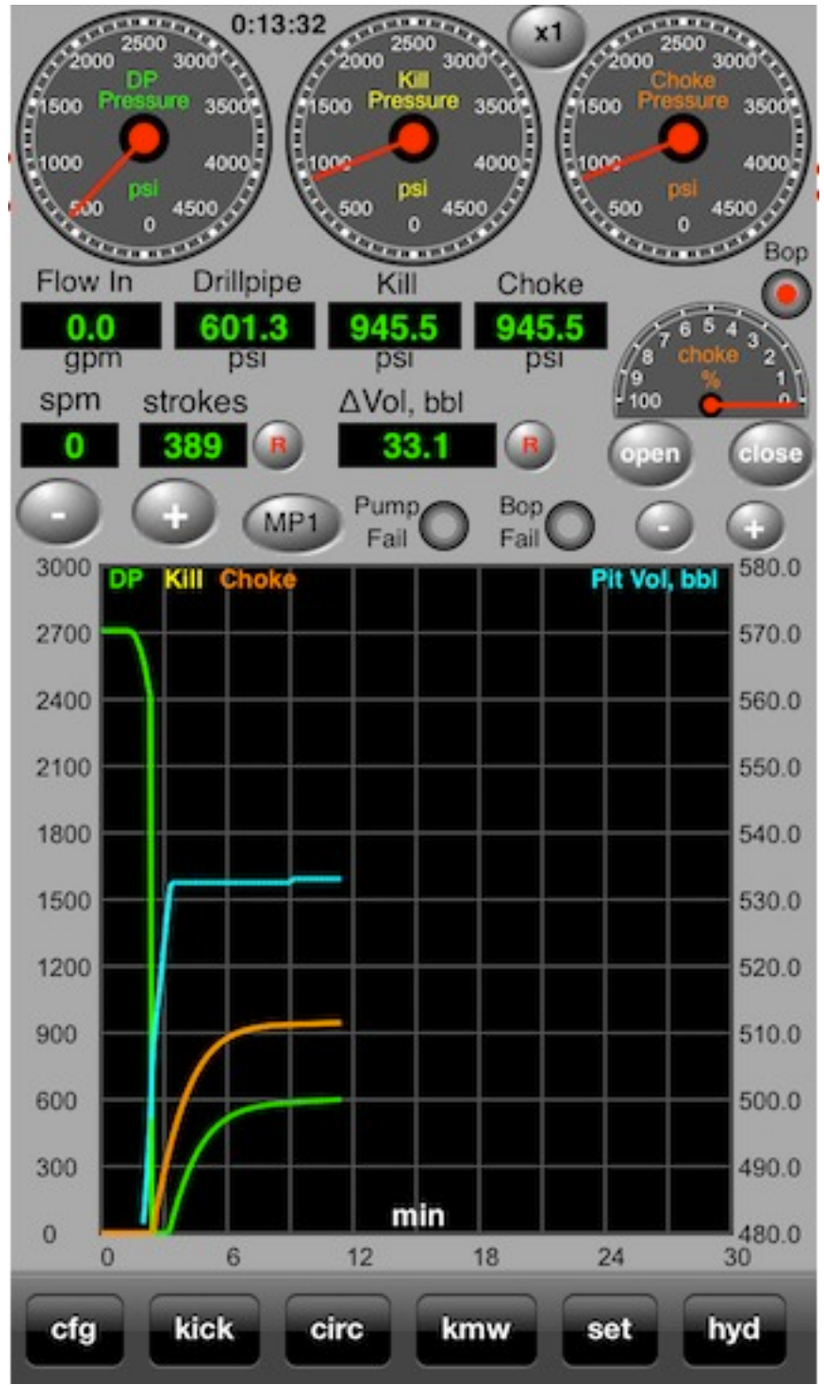
Move to “Drilling Simulator” and Tap on “Select App” button. Select the data file to import.



Tap on “**cfg**” button in Main View

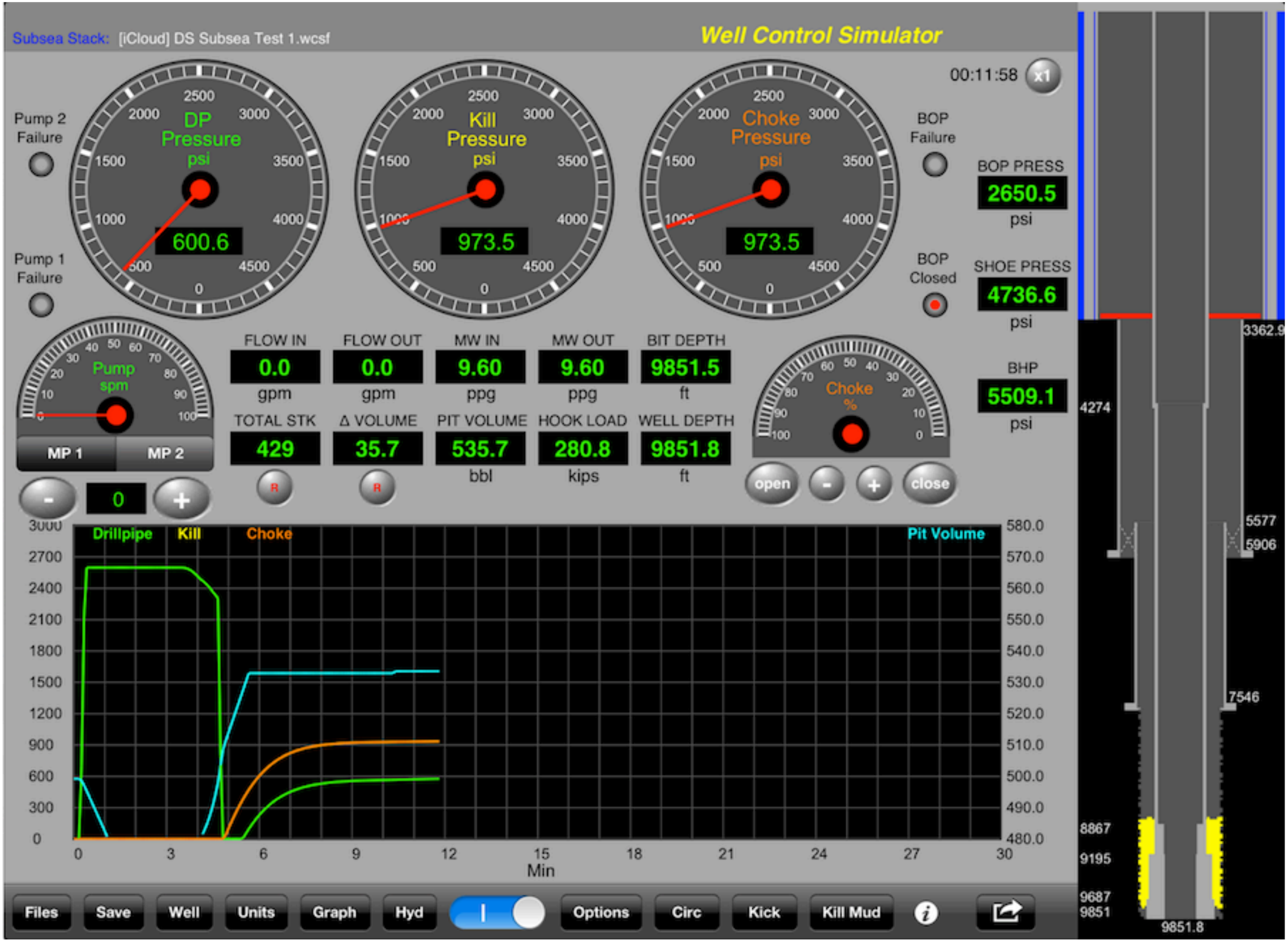


Select “**Data Files**”

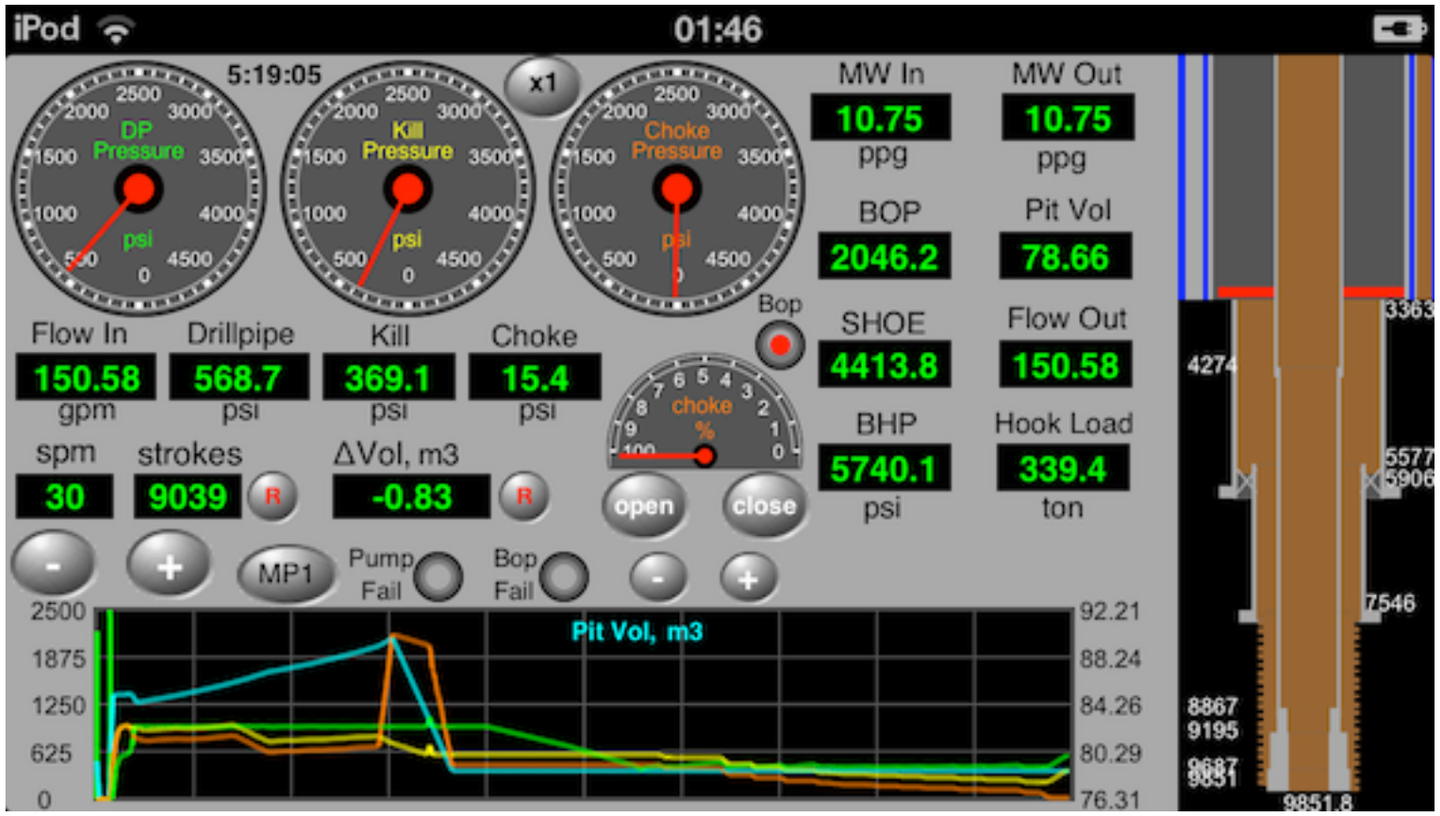


Open the “Well Control Simulator” app to Import from “Drilling Simulator” to apply a Method to control.

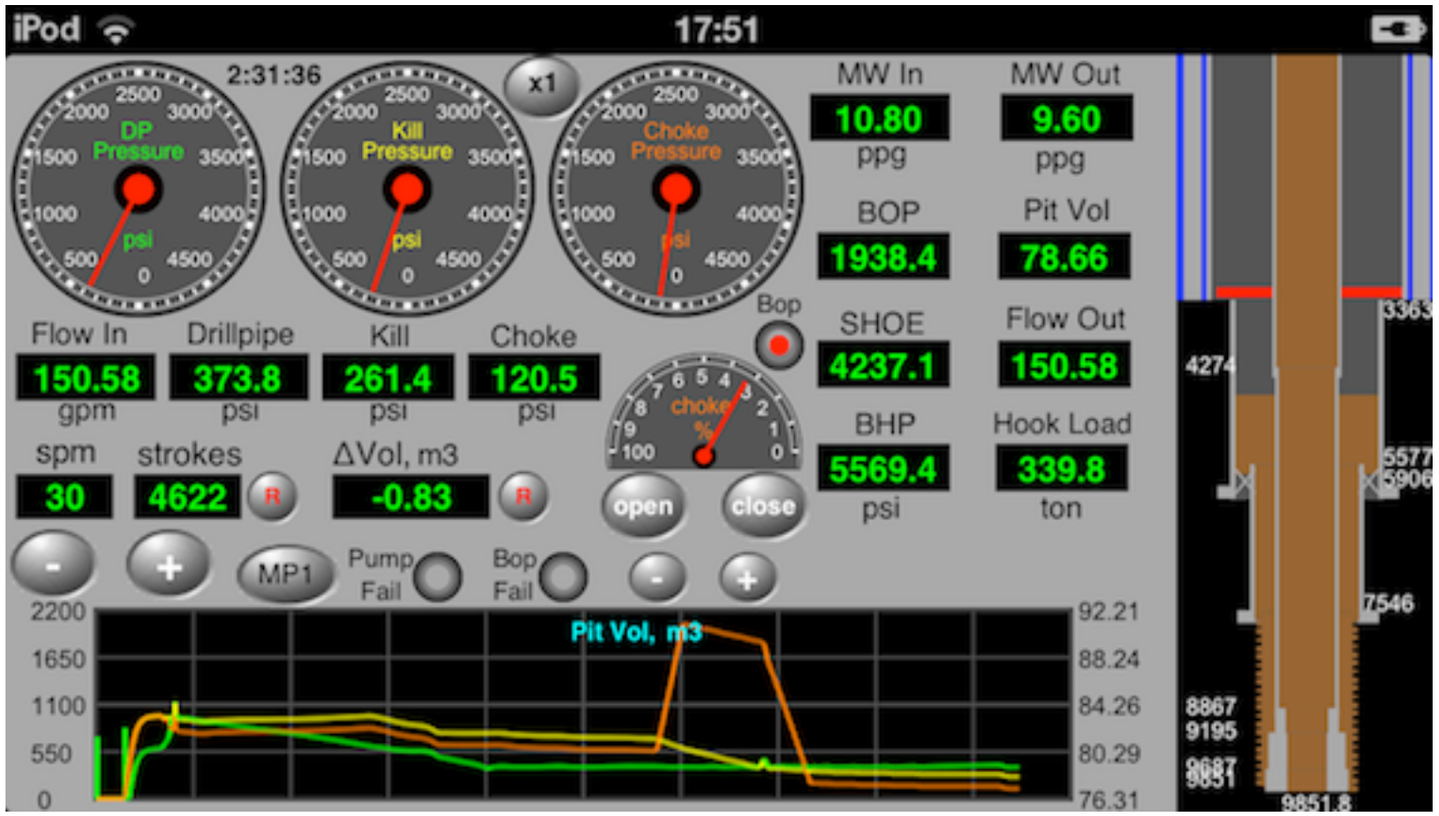
Example after importing from “Drilling Simulator”.



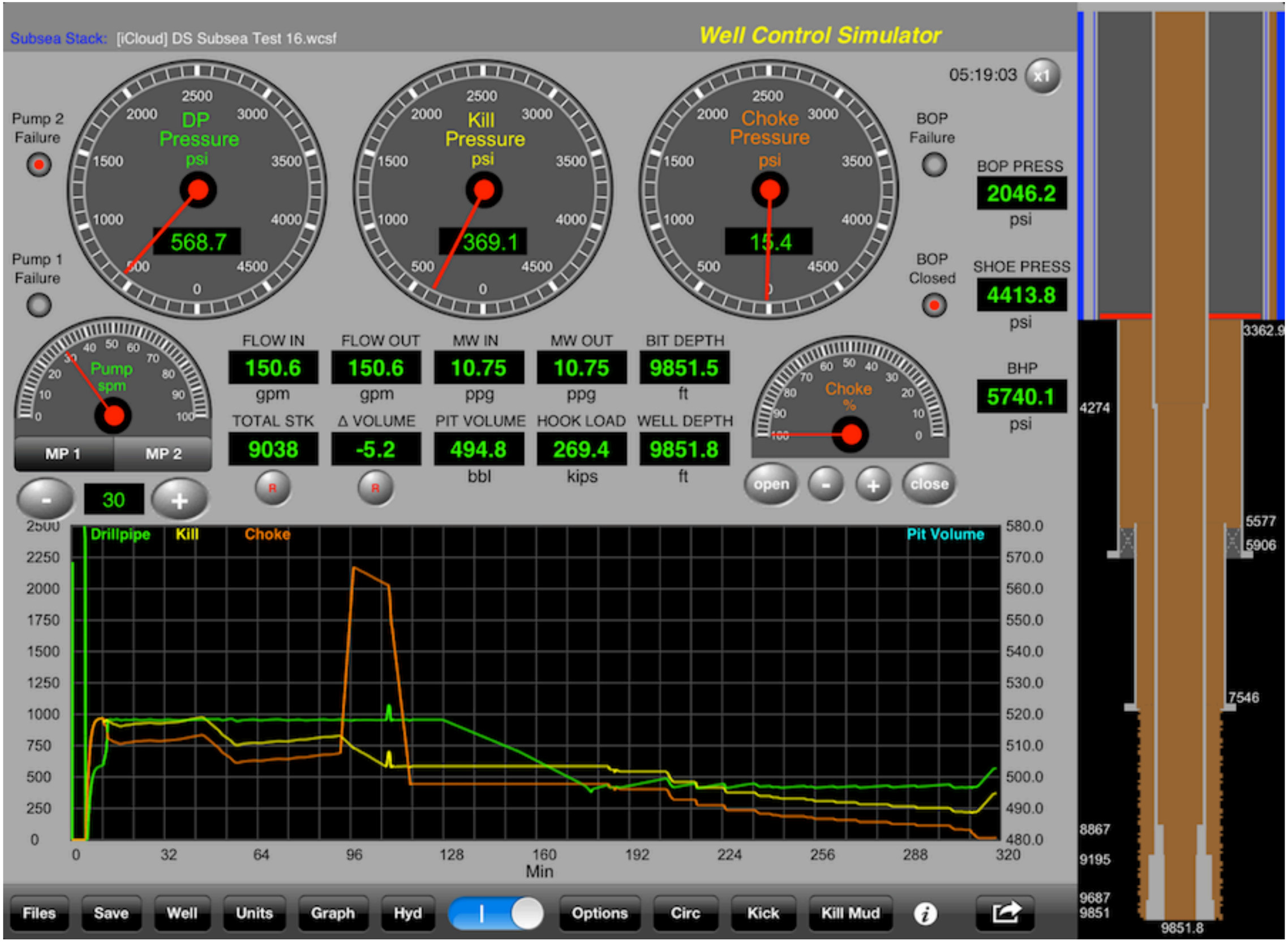
Example of the Driller's method on "Well Control Simulator" app. Check "Well Control Methods".



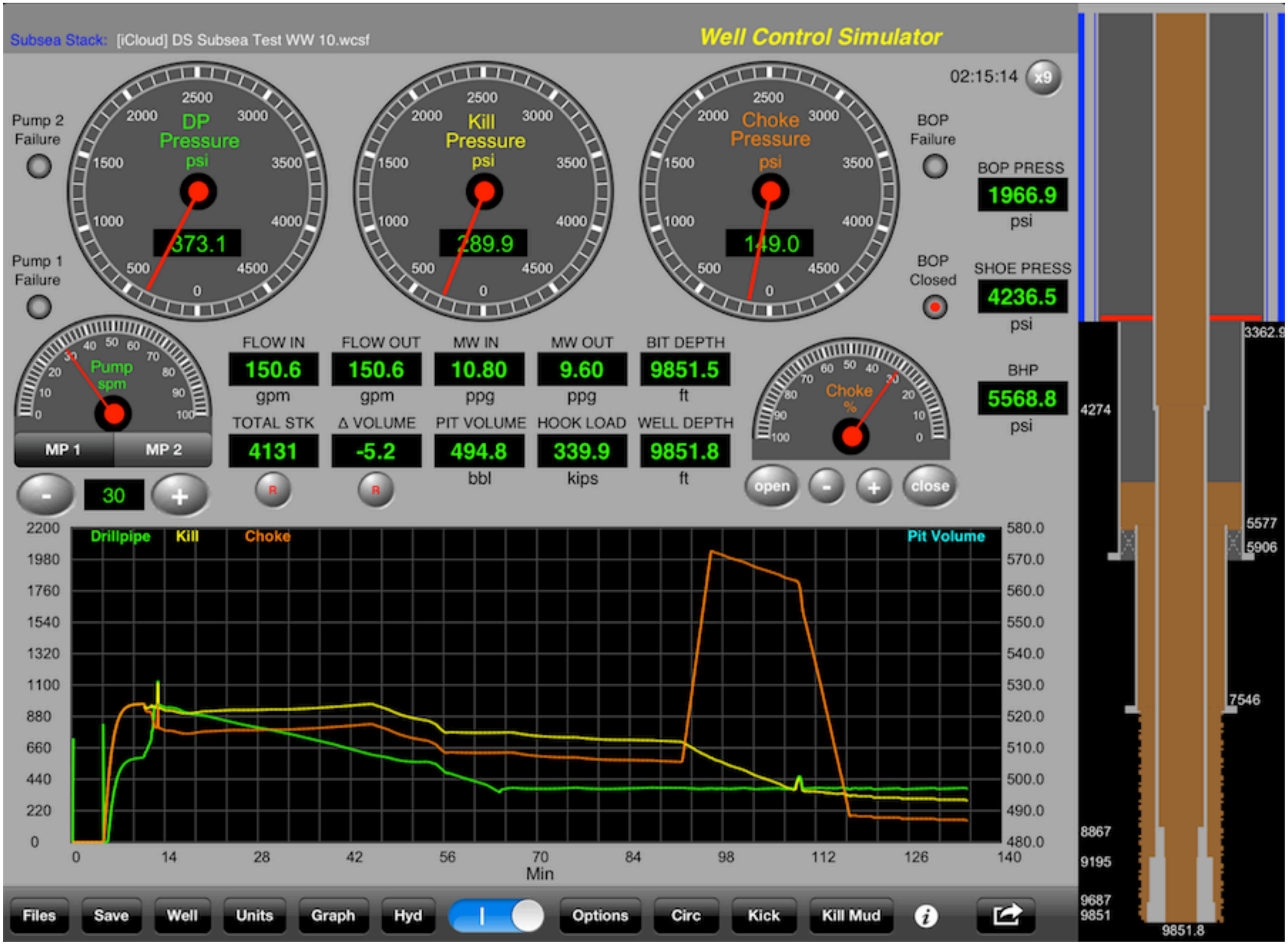
Example of the Driller's method on "Well Control Simulator" app. Check "Well Control Methods".



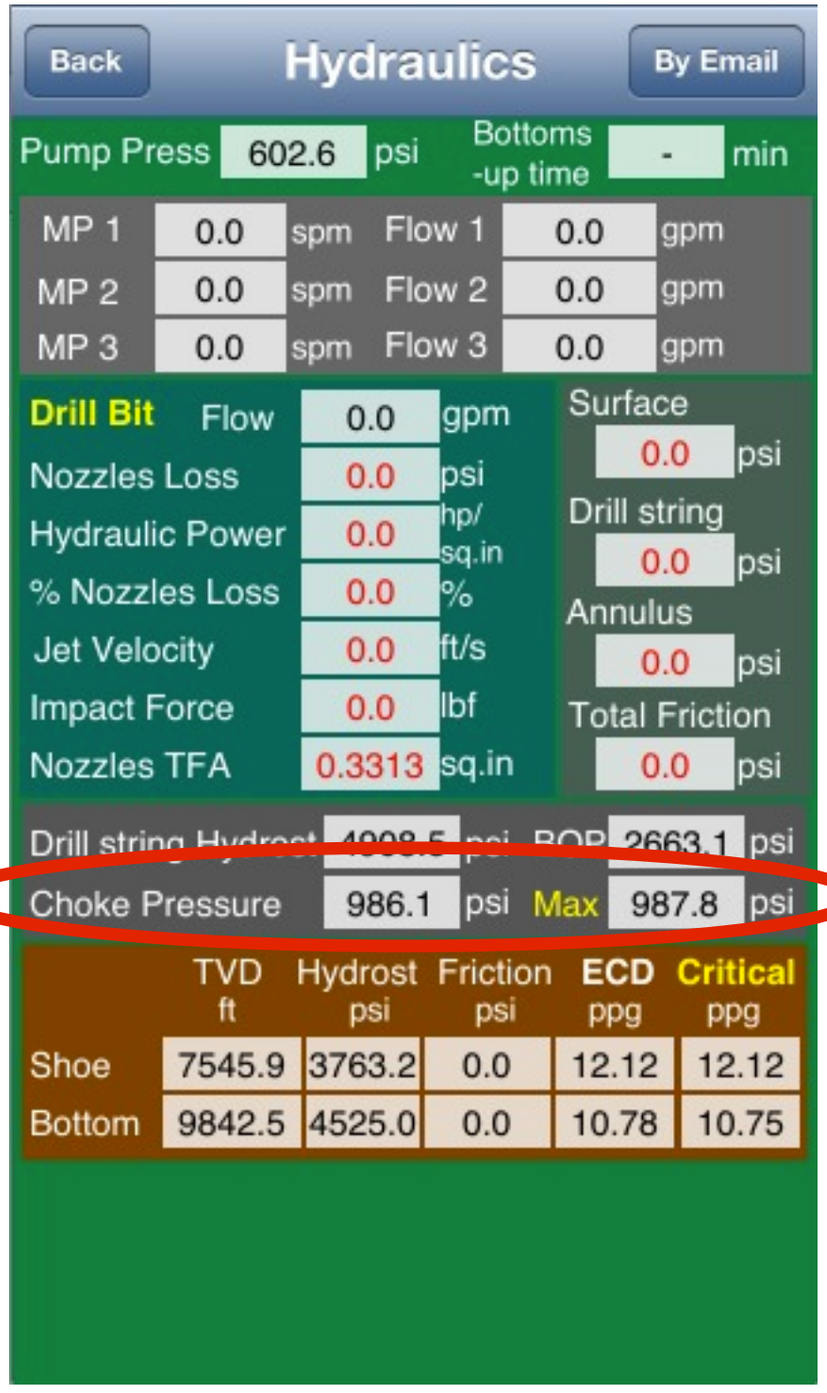
Example of the Driller's method on "Well Control Simulator" app. Check "Well Control Methods" or "Well Control Worksheets" apps.

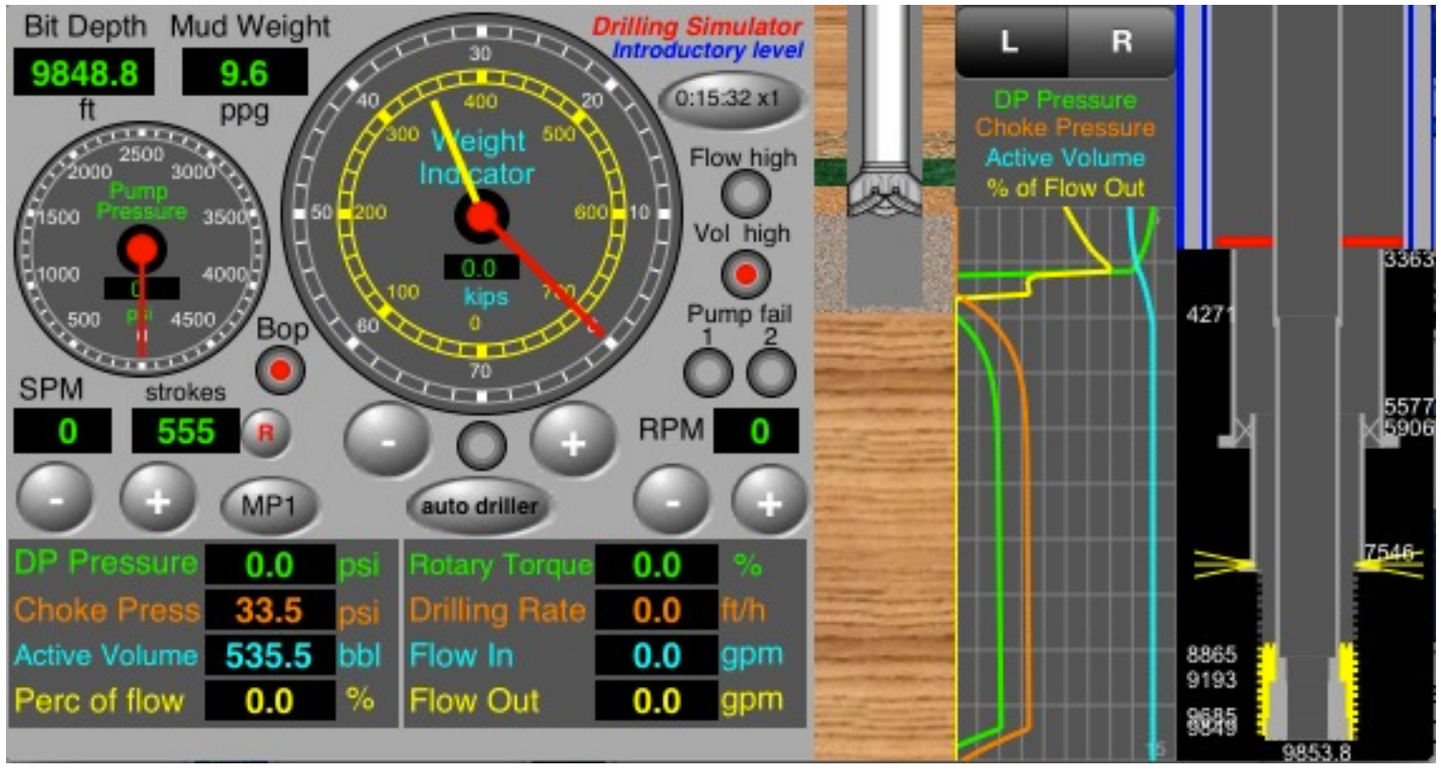


The Wait and Weight method on “Well Control Simulator” app. Check “Well Control Methods” or “Well Control Worksheets” apps.

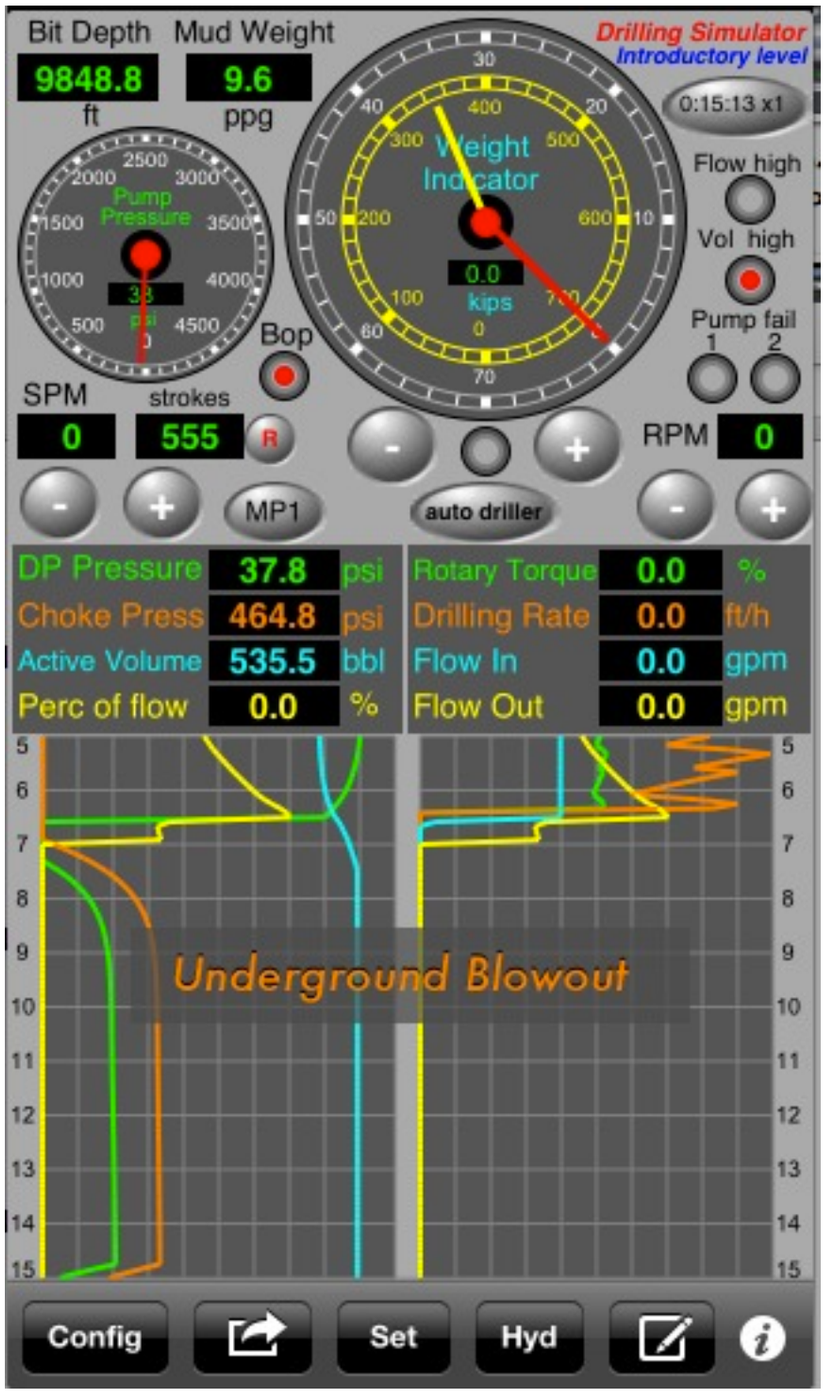


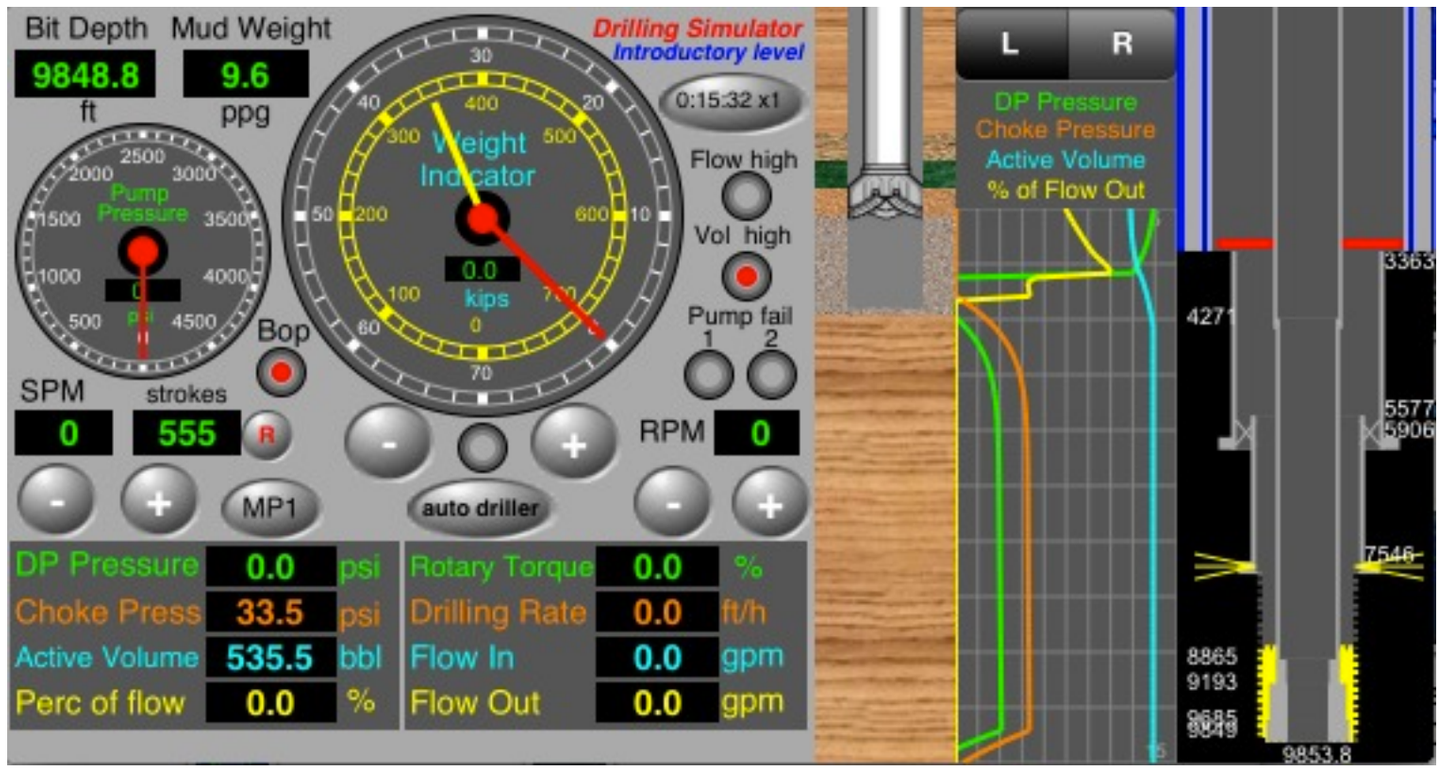
Check for the **choke pressure** to reach the **maximum choke pressure**. On hydraulics view, ECD = Critical Density on Shoe Depth:



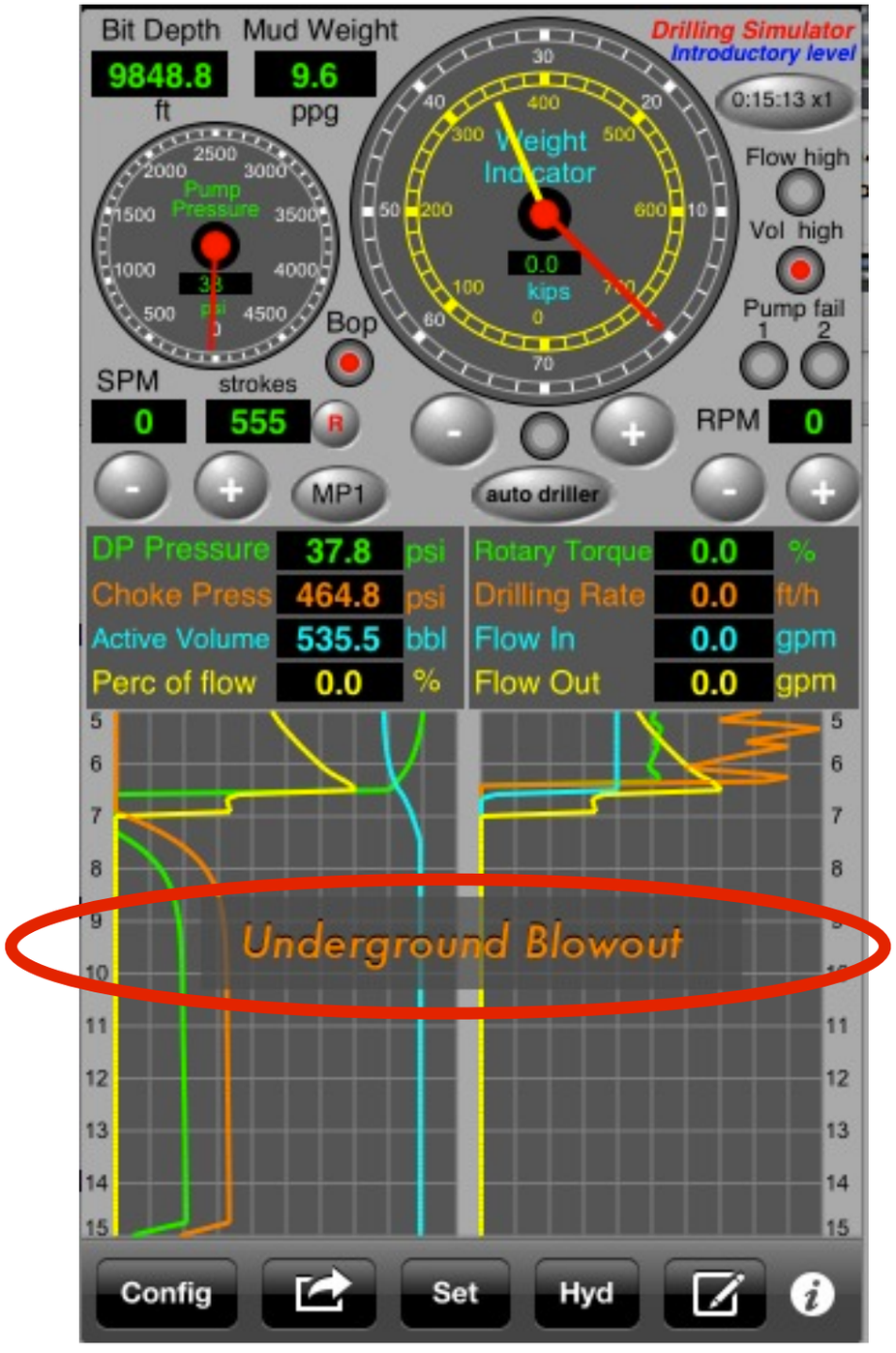


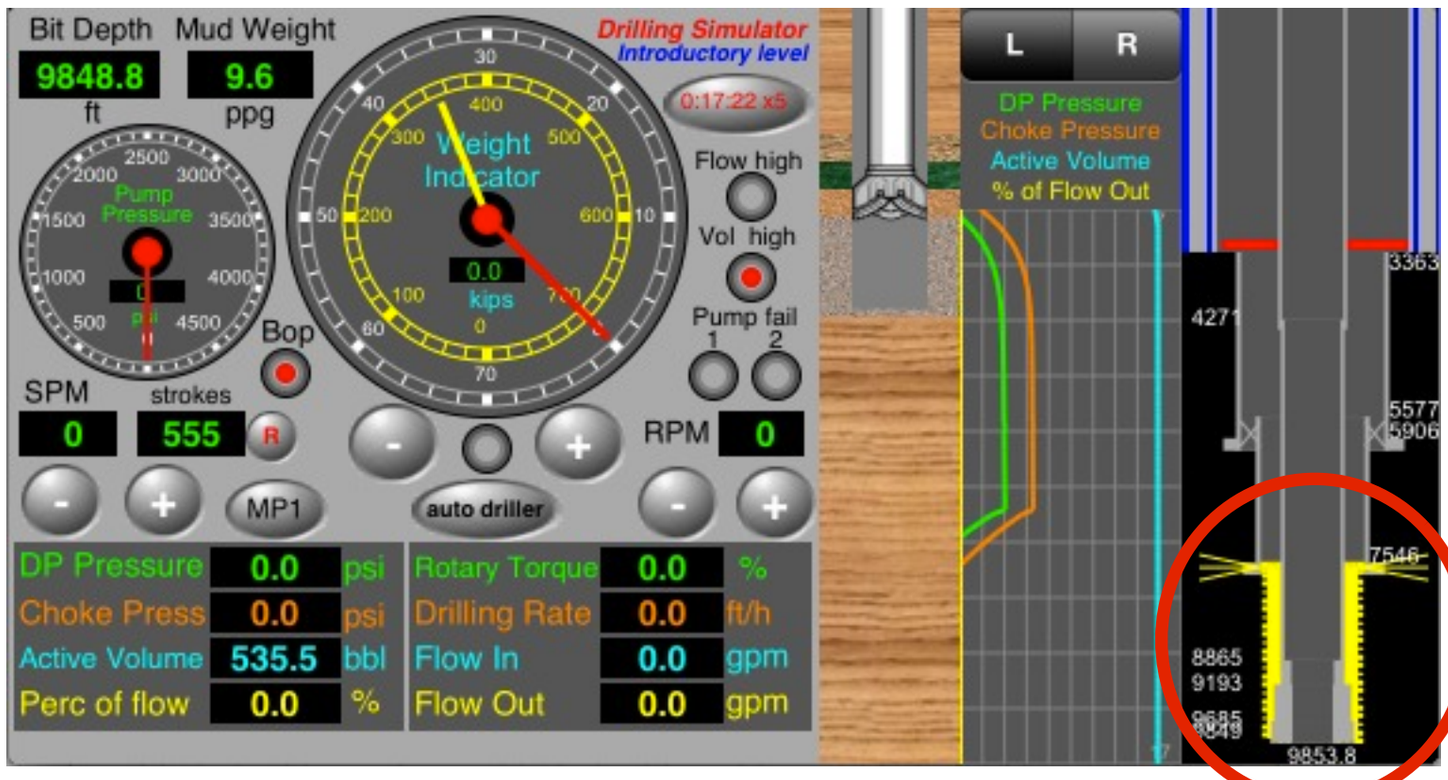
Shows the expression “Underground Blowout” in the graph with iPhone on vertical. Flashing until gas to reach on the shoe depth.



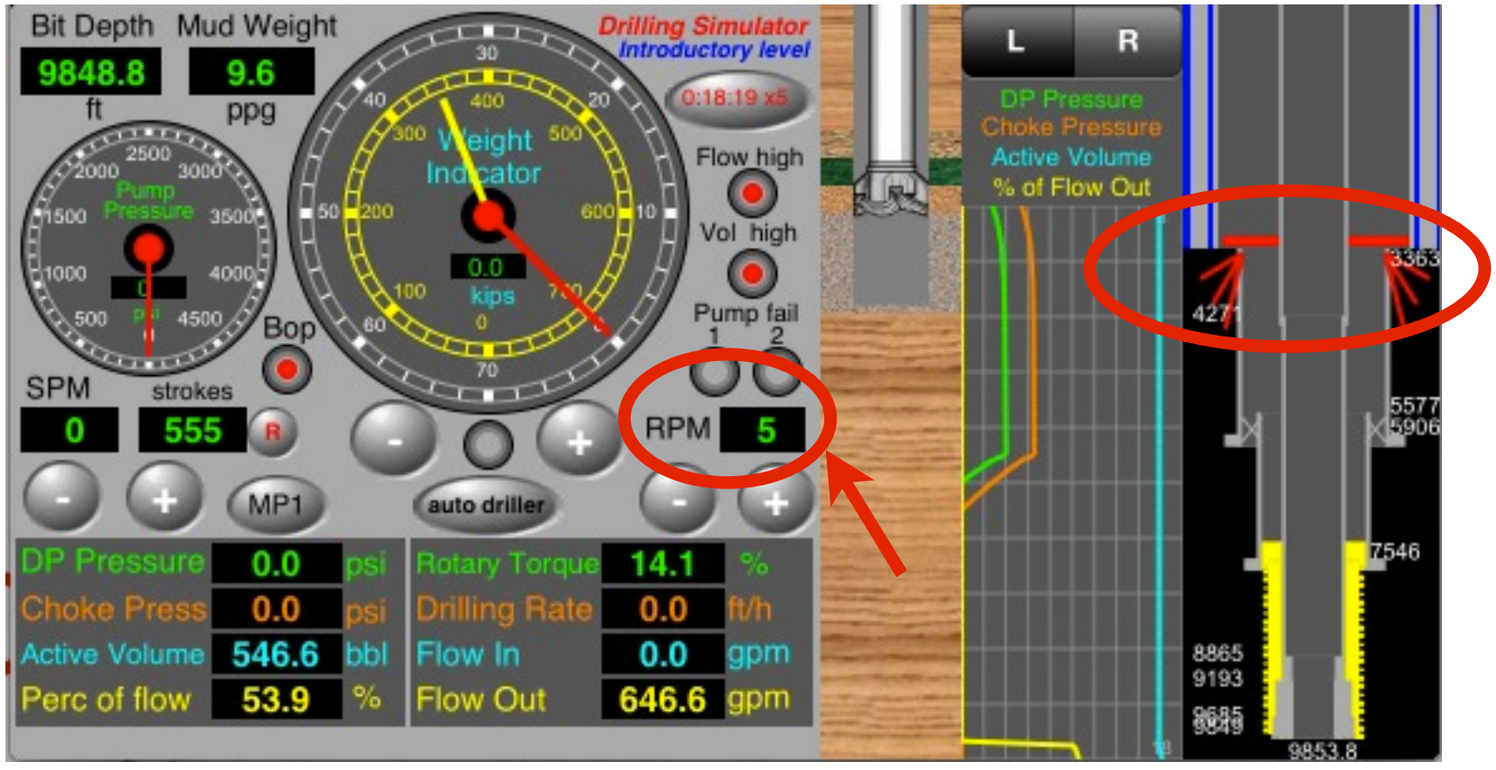


Shows the expression “Underground Blowout” in the graph. Flashing until gas to reach on the shoe depth.



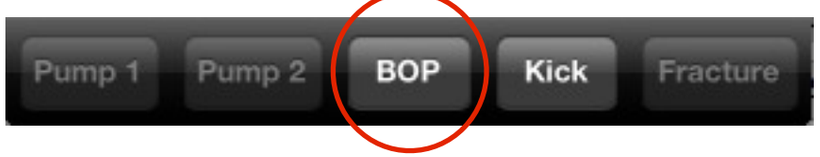


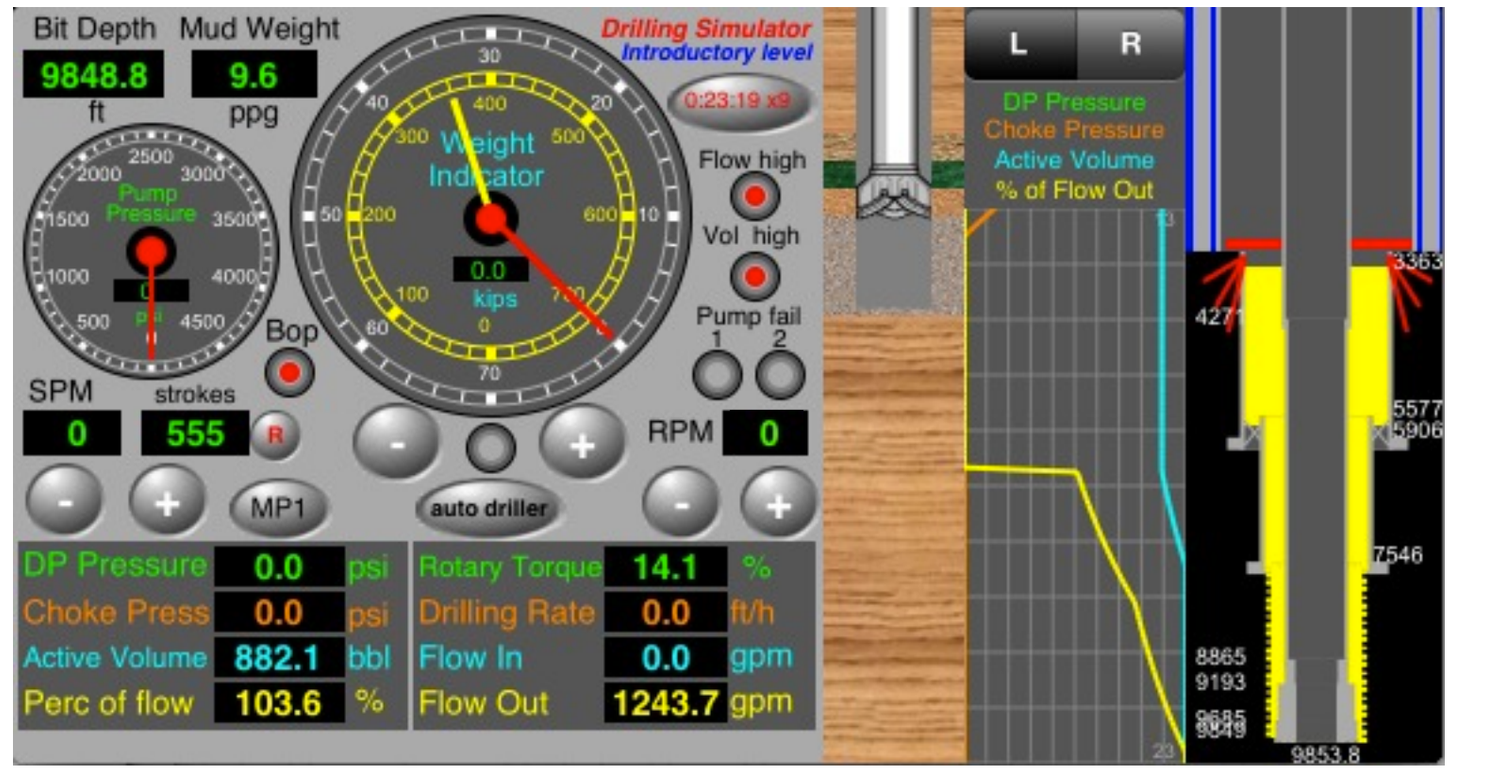
With Bop closed, set RPM = 5 to occur failure on the BOP.



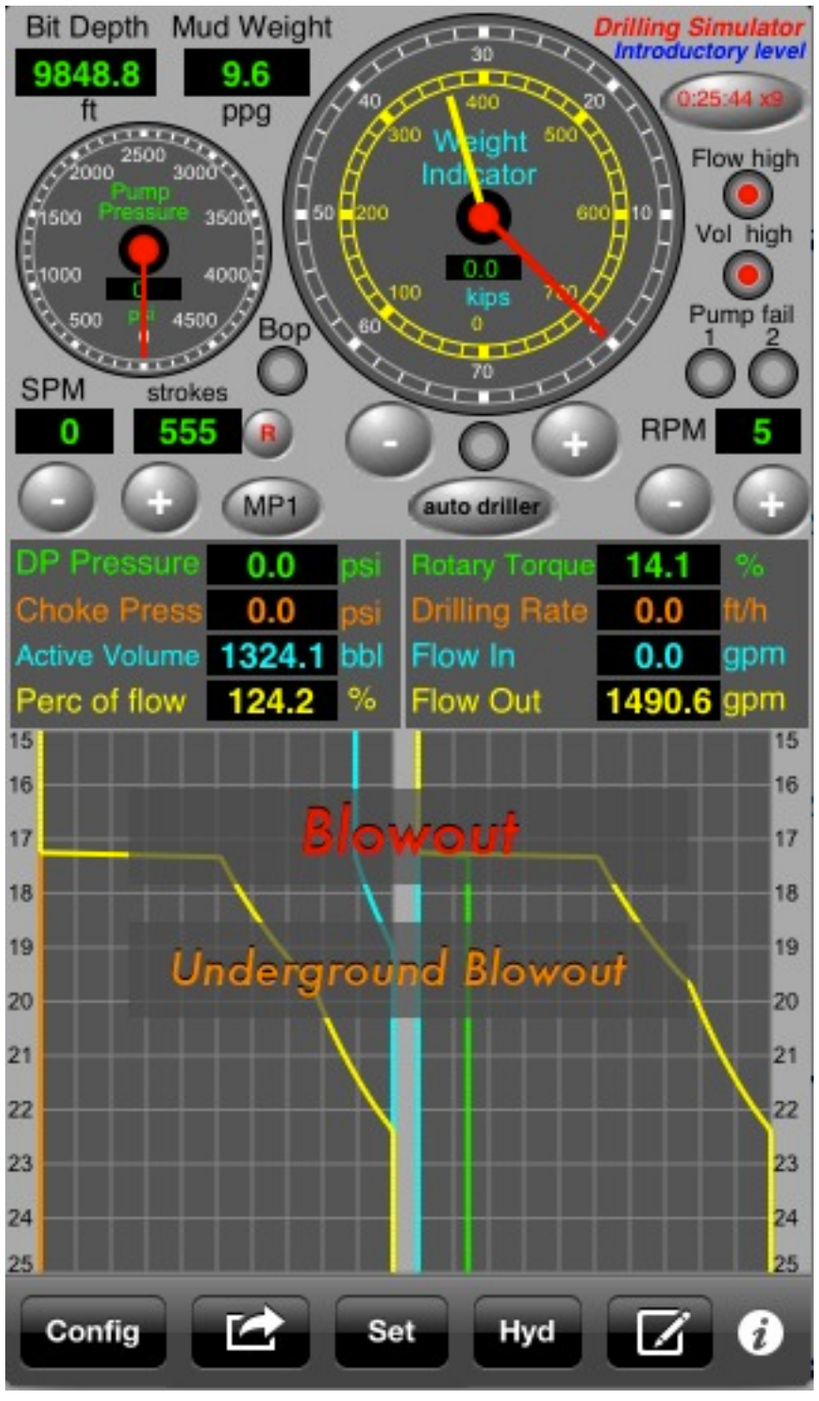
Same if RPM = 0 again, the failure on the BOP remains.

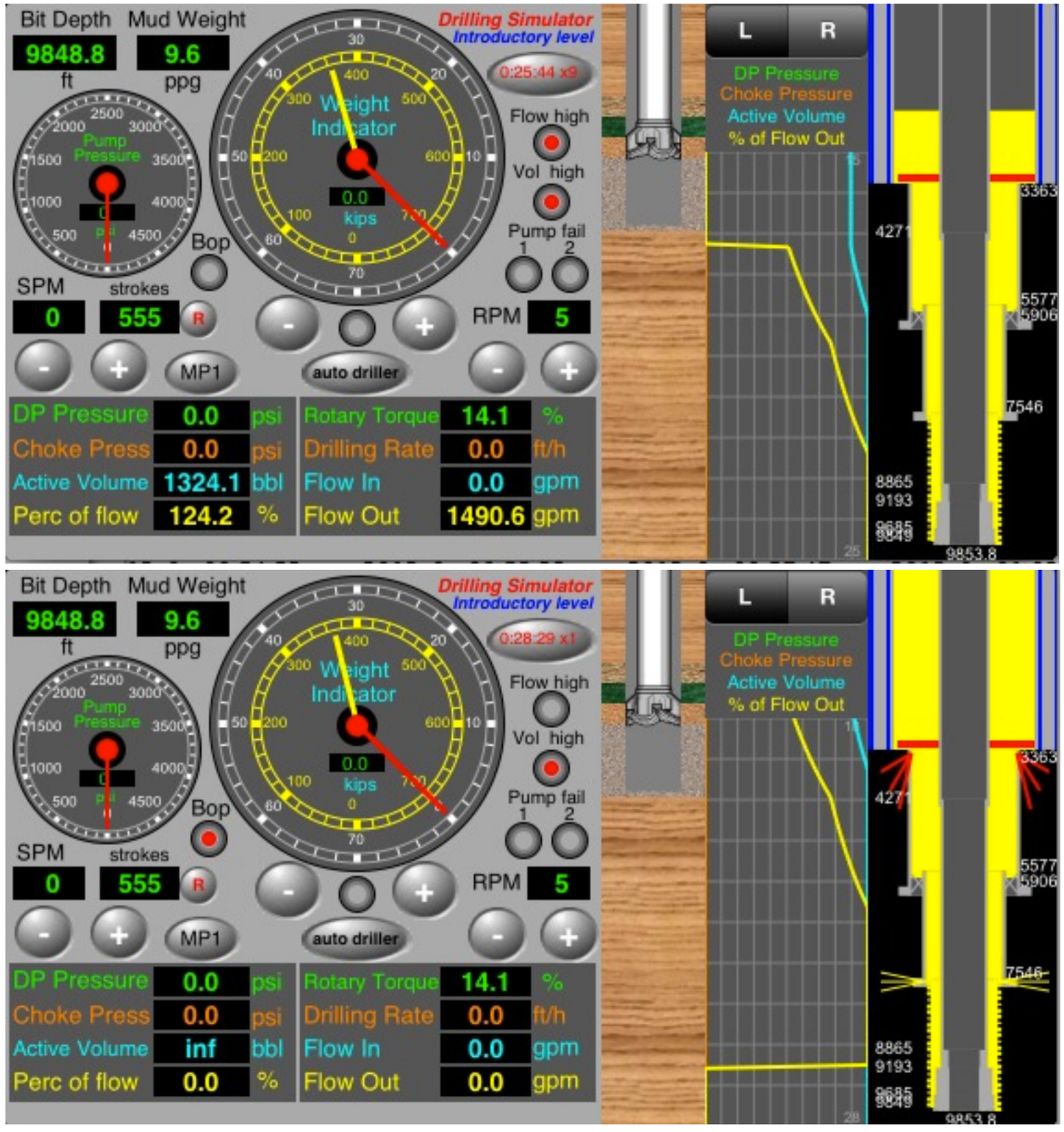
Reset failure



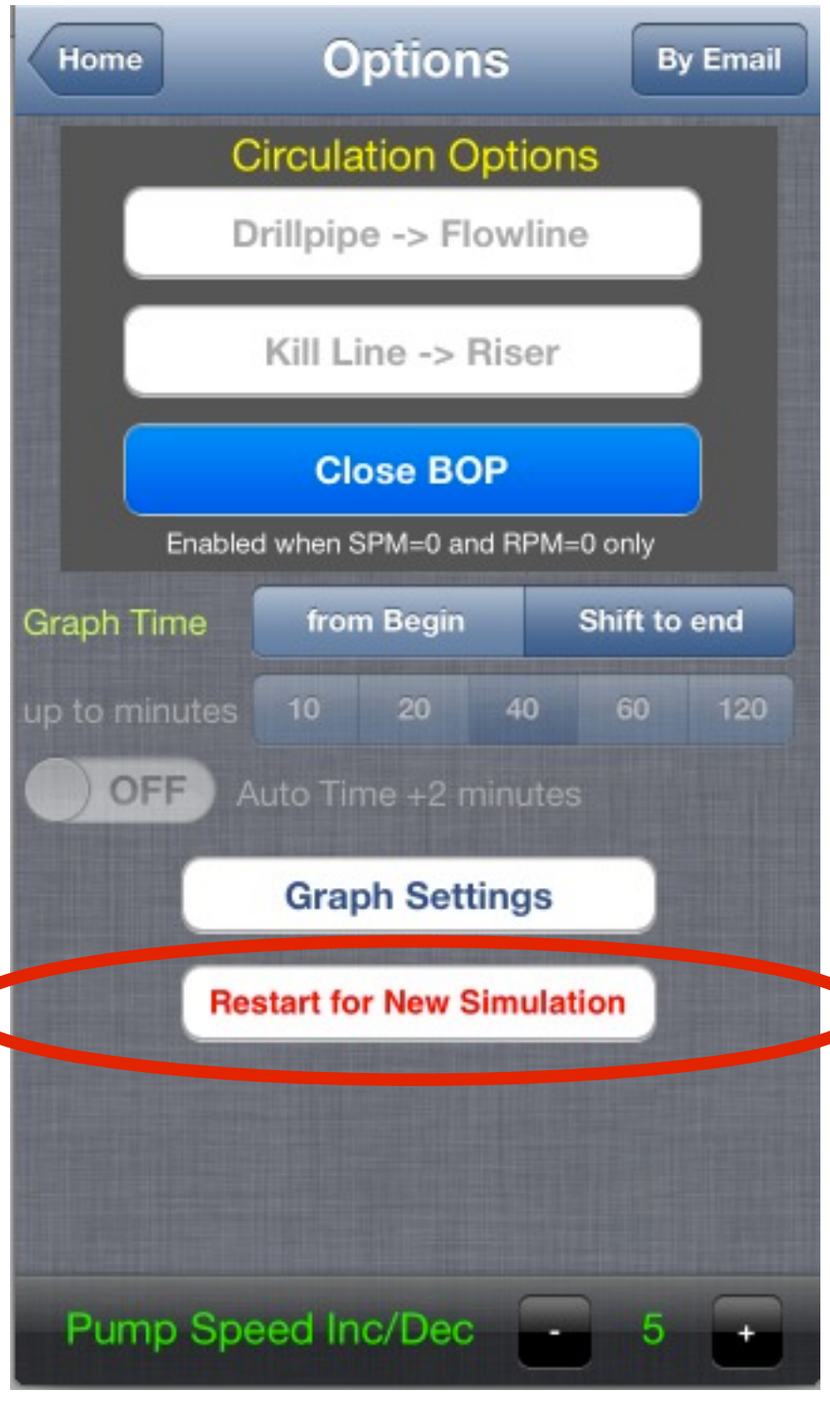


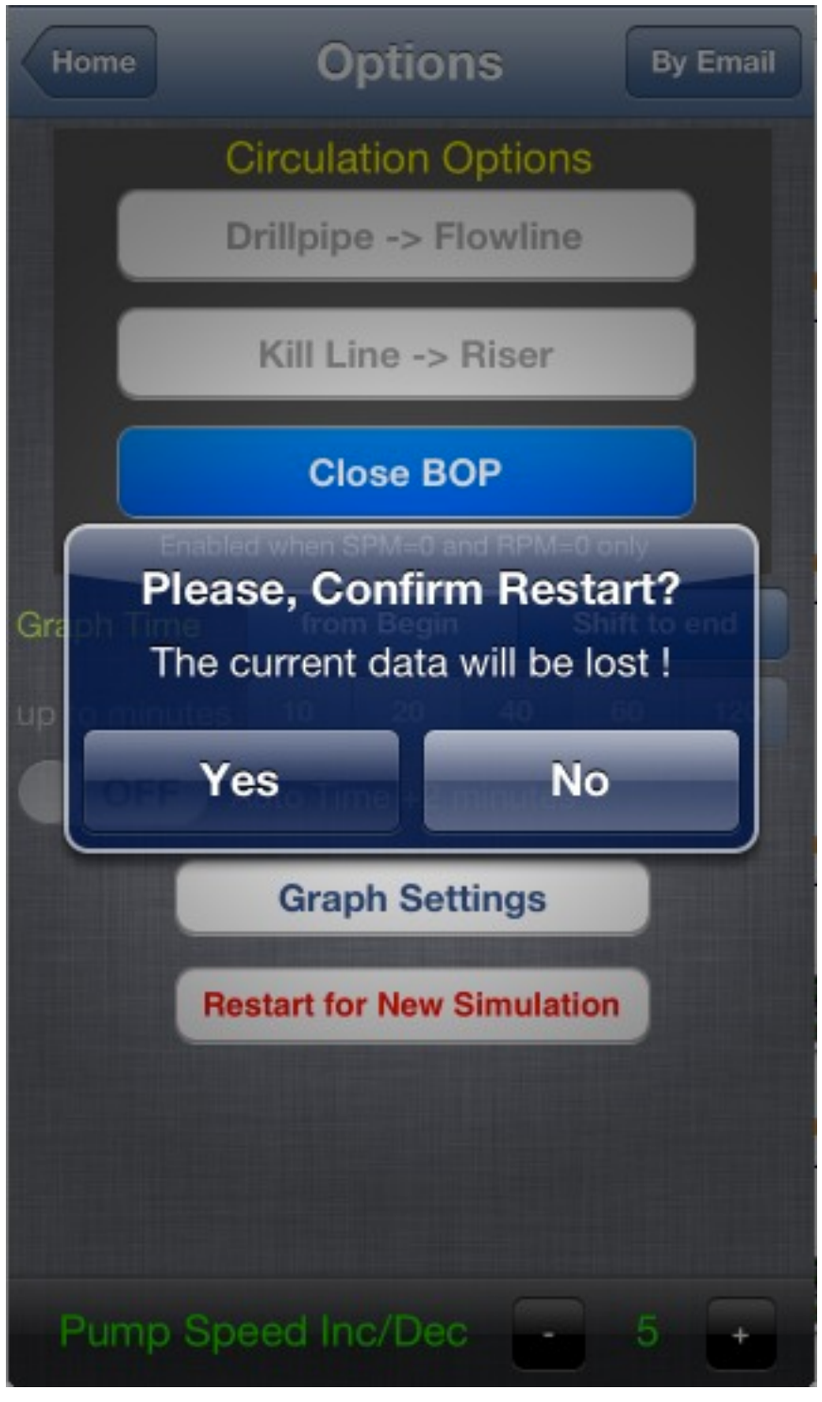
When the gas reach to BOP, shows the expression “Blowout” flashing in the graph.

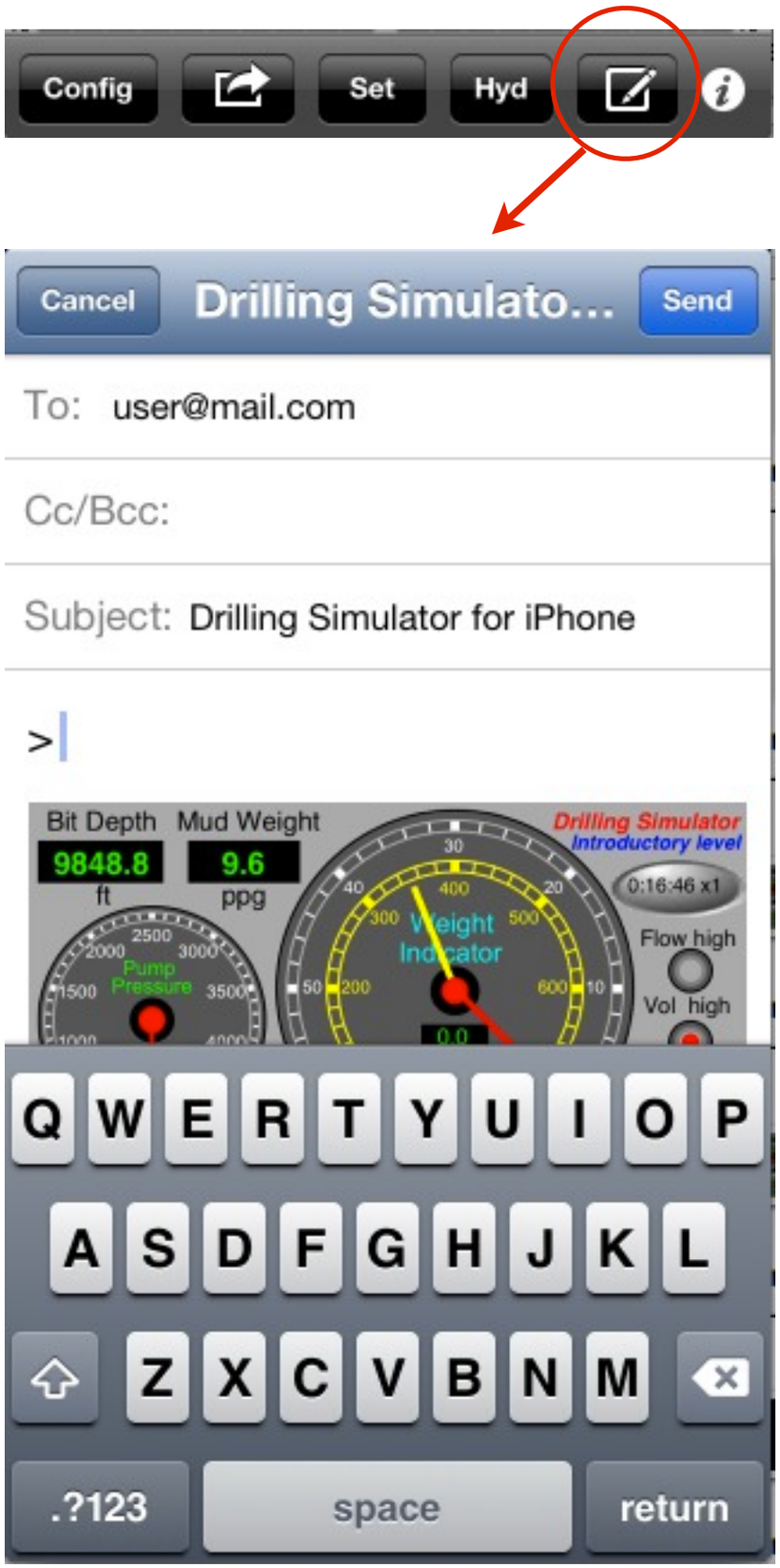


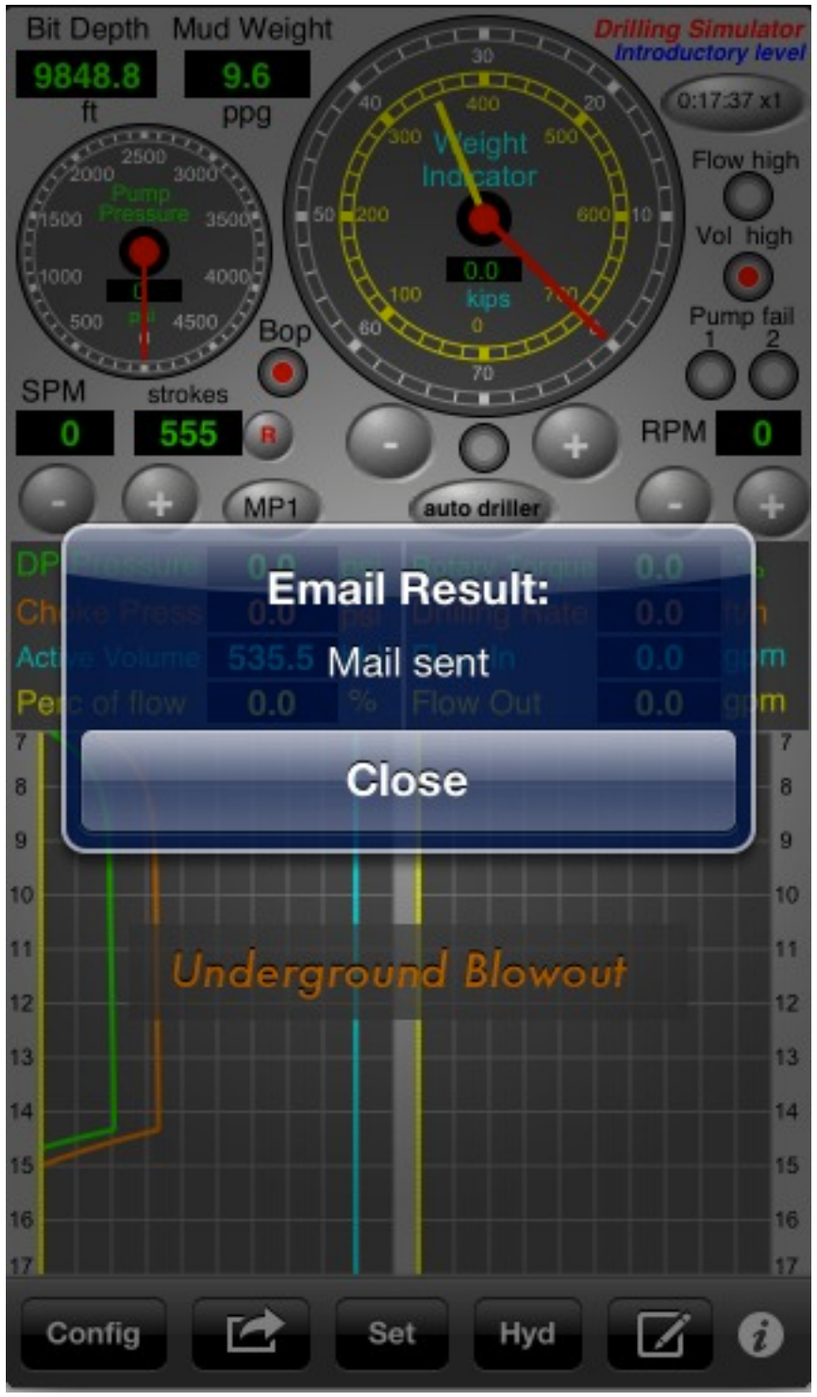


In blowout, when the Gas reach on surface, the simulation end. Tap on “Restart for New Simulation” button in “Options” view






Config
Set
Hyd
Cancel
Drilling Simulato...
Send
To: user@mail.com
Cc/Bcc:
Subject: Drilling Simulator for iPhone
>
Bit Depth
Mud Weight
9848.8
ft
9.6
ppg
Drilling Simulator
Introductory level
0:16:46 x1
Flow high
Vol high
Pump Pressure
Weight Indicator
0.0
kips
Q W E R T Y U I O P
A S D F G H J K L
Z X C V B N M
.?123
space
return


Bit Depth
Mud Weight
9848.8
ft
9.6
ppg
Drilling Simulator
Introductory level
0:17:37 x1
Flow high
Vol high
Pump fail
1
2
Bop
SPM
strokes
0
555
R
RPM
0
MP1
auto driller
Email Result:
Mail sent
Close
Underground Blowout
Config
Set
Hyd

About

This app was developed based on my experience.
There was no comparison with any other software.

Our goal was to create a low-cost application with the help of experts to share with drilling engineers, technicians, drillers and students.

You can contribute with suggestions for improvements, correcting the translation to english, reporting bugs and spreading it to your friends.

Please visit our support url and see other applications for Oil & Gas for iPhone, iPod Touch, iPad and Mac OS X.

Contact:
contact@wellcontrol.com.br

Support URL:
http://www.wellcontrol.com.br

On App Store:
Oil & Gas Apps for iPhone and iPad