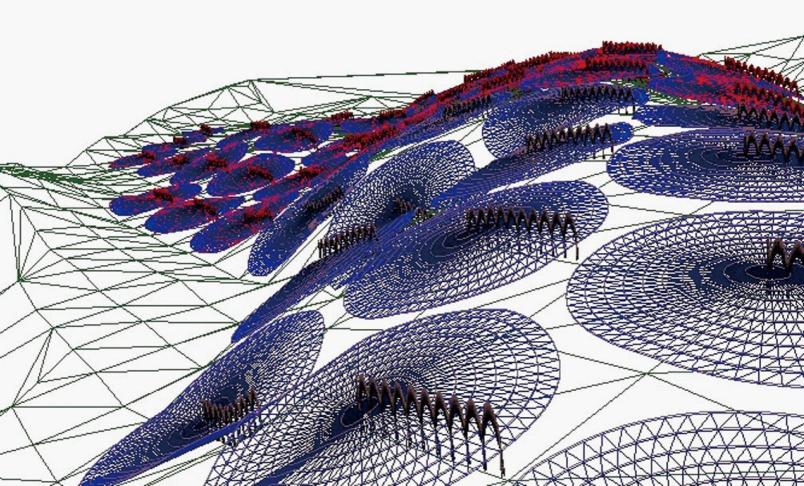


# **® PIVOT • PIPE • PUMP**

Professional irrigation design service



# How to pump water to the field on hill

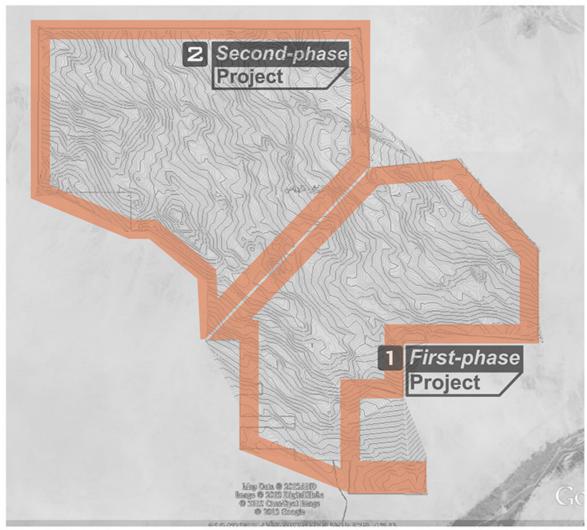


Total area.

This land is 100,000 ha on the hill. The southeast of the boarder is about 7 KM away from the river.

The sofeware calculation uses elevation data from satelite image.

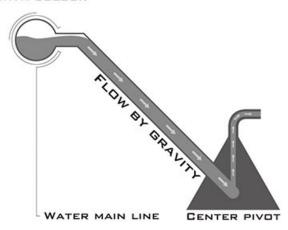
The 1st phase: 400 pivot machines. The 2nd phase: 400 pivot machines.



First/Second-phase Project.

#### LEGEND OF ALTITUDE WITH COLOUR

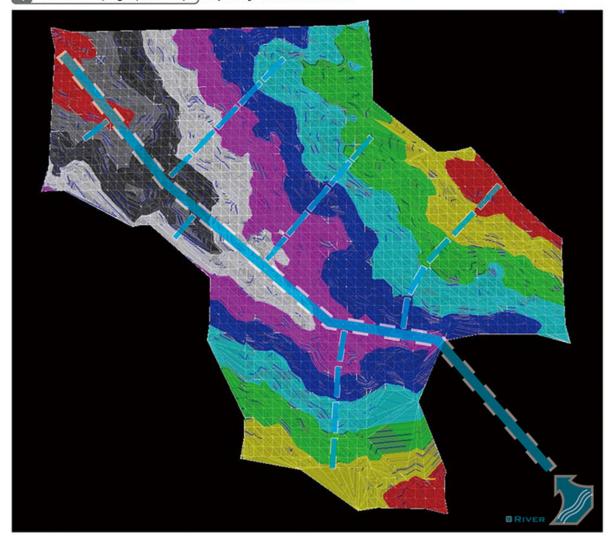




This coloured map shows the altitude of the land.

The high land is on the line from the southeast to the northwest. If the water main pipe is built along this line, most part of the land can be irrigated by gravity, which is the most efficent and economic arrangement.

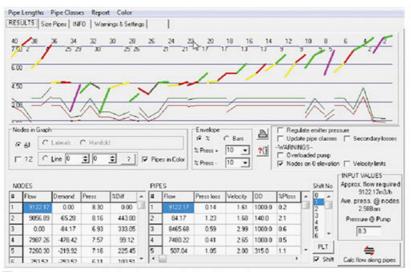
Colored topographic map. Pipe layout for all area .







#### Main pipe assembly





All the pressure and pipe sizes are calculated by software



Pipe assembly



Aqueduct



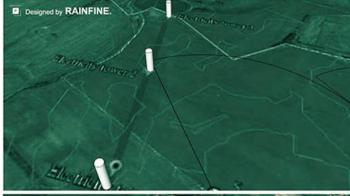


# How to maximize the irrigated land



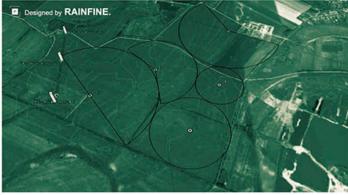
For maximum covering the land by center pivot, the circles can be designed in any angles to avoid the obstacles.

Usually a small pivot can be inserted into the bigger circles to fill up the land.



The obstacles in field might be:

- Houses
- ② Electric powerline towers
- Roads
- Water pipes
- Trees
- Others









When the pivot is designed as a partial circles, the barricade will be used at both ends near the blocks to switch off the switches on the last tower of the pivot and stop the machine.

Some auto reverse device is used to restart the machine and work backward direction when necessary.



# How to maximize the irrigated land

#### TRANSVERSER SLOP

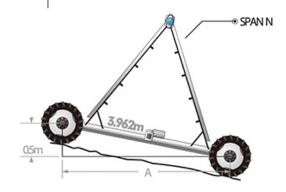
 $A = \sqrt{3.962^2 - 0.5^2} = 3.930$ 

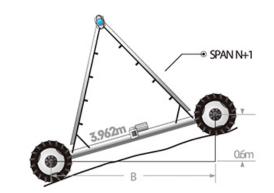
SlopN = 
$$\frac{0.5}{3.930} \times 100\% = 12.7\%$$

$$B = \sqrt{3.962^2 - 0.6^2} = 3.916$$

SlopN+1 = 
$$\frac{0.6}{3.916} \times 100\% = 15.3\%$$

The maximum allowable slop in this situation is 30%





#### LATERAL SLOP

$$A = \sqrt{54.56^2 - 10^2} = 53.63$$

Slop = 
$$\frac{10}{53.63} \times 100\% = 18\%$$

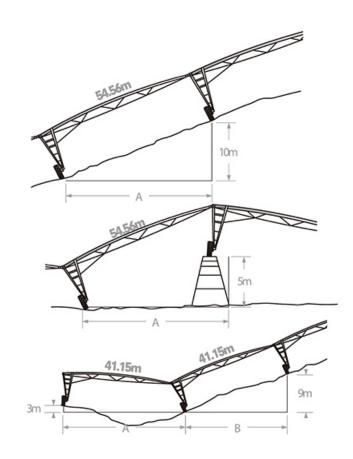
$$A = \sqrt{41.15^2 - 3^2} = 41.04$$

SlopA = 
$$\frac{3}{41.04} \times 100\% = 7.3\%$$

B = 
$$\sqrt{41.15^2-9^2}$$
 = 40.15

SlopB 
$$=\frac{9}{40.15} \times 100\% = 22.4\%$$

The maximum allowable slop in this situation is 30%





The pivot is working over the house.





The pivot center was built on the concrete table.



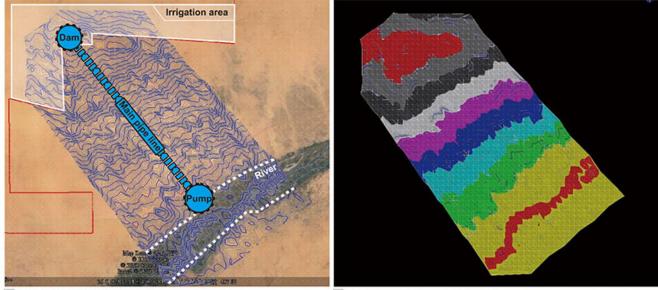
Grazing dairy farm in Australia.



Milking house in the center.

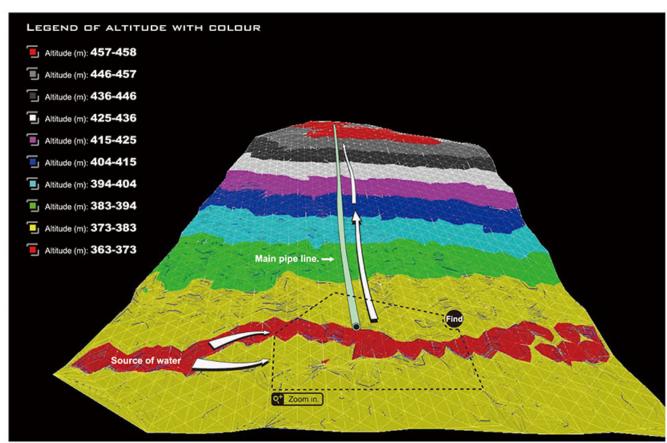


## How to use water from river

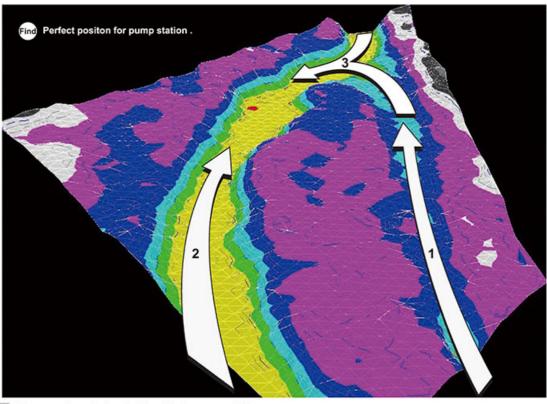


Analysis of the topographic map.

Altitude can be seen from colours.



Main pipe arrangement.



The secret is:

Arrow No.1 is the main river with water.

Arrow No.2 is a dry river bank (old main river) without water.

After zoom in we find perfact location for pump station.

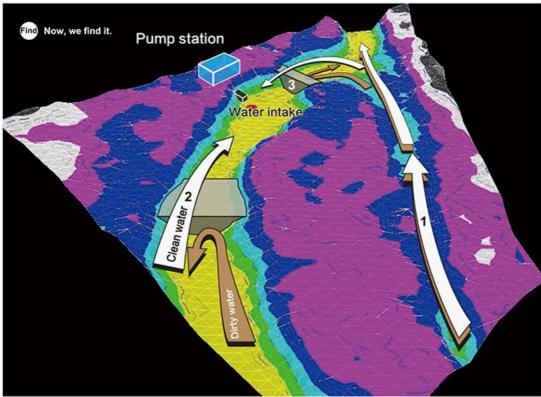


If we cut the river bank from arrow No.3, water can flow back to the dry river bank, which is similar to this photo.





## How to use water from river

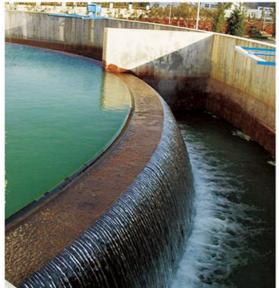


If we build two weir gates at the position No.2 and No.3, there will be a dam between two weirs.

It will form a filter system. Only clean water can flow over the weir to position 3.

At position 2, flood can clean the dirt and sand when weir gate 3 is openning.

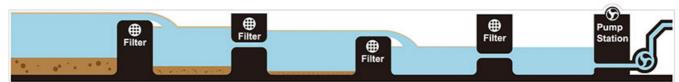
Weir gate filter system.



Filter: water flow in.



Filter: water flow out.



Automatic flow filter system.



Pump station and filter screen.





Main canal and pump station.

Pump station with water hammer protection system.

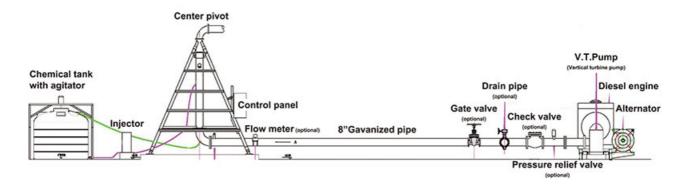




# How to use water from bore well



Pump water from bore well in Saudi.





Diesel engine with alternator

Gear box

Vertical turbine pump

Rainfine center pivot

Rainfine pivot injector

## How to irrigate the corner of the pivot

#### SOLUTION 1.





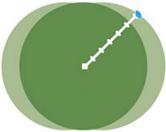
The steerable corner system is used to irrigate the four corners of the square and maximum the irrigation area. The last span can be extended to the maximum length in the corner and folded in the retracted position. The corner pivot consists a 6-5/8" diameter by 61.3m or 54.5m long span with an 26.8m overhang. When the corner span is fully extended, it will add 85m or 78m to the overall length of the main system. This system has a high cost.



Extended to maximum length.



Folded in retracted position.



When there are no obstacles at both sides of the arm, span can be extended to straight and cover more land.



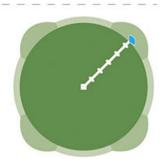
When the obstacle is inside the circle, the corner system can avoid the obstacle and maximize the field coverage.

#### SOLUTION 2



End gun and corner angle switch on/off.

End gun is normally used at the end of the pivot to cover more land. In the pivot center there are four corner control switches to start/stop the end gun at the corner angles in case that the corner can be irrigated. It is a low cost solution but it can only cover part of the corner.



#### SOLUTION 3



Plastic pot sprinklers.

Plastic pot sprinklers are connected together with PE hoses and layout on the comer of the pivot. Water is supplied at the end of the pivot span with quick coupling. When pivot moves to the corner, one person can use hands to connect the PE hose to the water hydrant at the pivot end span. When pivot moves out the corner, the water hydrant can be disconnected. This system can cover almost all the corner. The investment is expensive than solution 2 but it is far more cheaper than solution 1.



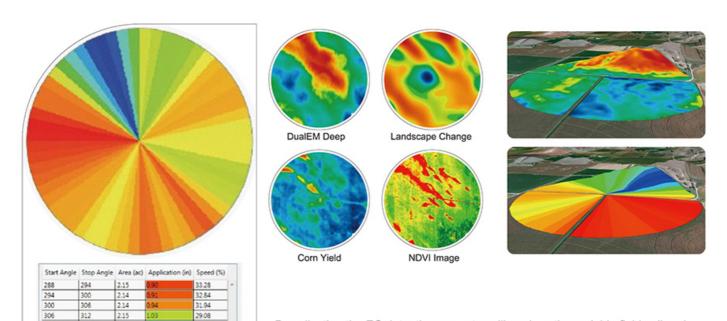




# Precision irrigation for pivot



Collect EC (electrical conductivily) with RTK elevation data.



By collecting the EC data, the computer will analyze the variable field soil and set up the pivot irrigation rate according different soil water infiltration. This yield optimigation technology can help farmers to increase the yield, save water and energy.

Different water infiltration of the soil.

2.14

2.14

2.15

26.16

24.73

24.21

312

318

330

336

318

324

330

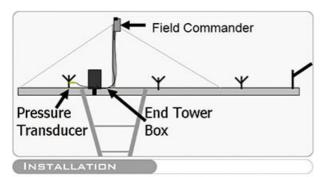
342

#### Remote control





Soil tilth monitor. Wind monitor. Rainfall monitor.



### GPS driven device

- Communicate via digital network
- Monts on end tower

10-C m		

	BASIC	ENHANCED	PRO
Stop	•	•	•
Stop At	•	•	•
Stop by Time	•	•	•
Speed		•	•
End Gun		•	•
Start			•
Direction Change			•
Speed			•
VRI Table			•
Start Wet			•
Start Dry			•
Aux Speeds			•

## MONITORING

	BASIC	ENHANCED	PRO
Start	•	•	•
Stop	•	•	•
Stop At	•	•	•
Stop by Time	•	•	•
Safety	•	•	•
Direction	•	•	•
Speed	•	•	•
GPS Position	•	•	•
Water pressure	•	•	•
Status Alert	•	•	•
Last Reading	•	•	•
Run Time	•	•	•
Revolutions	•		•
Signal strength	•	•	•
Wet Hours	•	•	•
Battery voltage	•	•	•
Relay State	•	•	•
Run Hours	•	•	•
Stuck Alert		•	•
Acre In. Applied		•	•
Theft Monitoring			•
Crash Zone			•
Temp/Hum			•
Wind Spd/Dir			•
Precip			•

## Remote control Irributler™

#### Information collection:

Soil tilth

Moisture

Climate report

Photo

#### Remote control:

PC or cell phone can be used to control your pivot wherever you travel or stay at home.















## PERCENTAGE TIMER











#### Crop info:

#### Crops

Different crop season area needs different irrigation rate.

#### Root depth

Different depths of crops need different irrigation rates.

#### Period of growth

From the period of seeding to the harvest, irrigation rate varies.

#### Information collection:

- 1.Rainfall monitor
- 2.Soil moisture sensor
- 3.Soil infiltration
- 4.Wind monitor
- 5.Slop monitor
- 6.Real photograph transmission

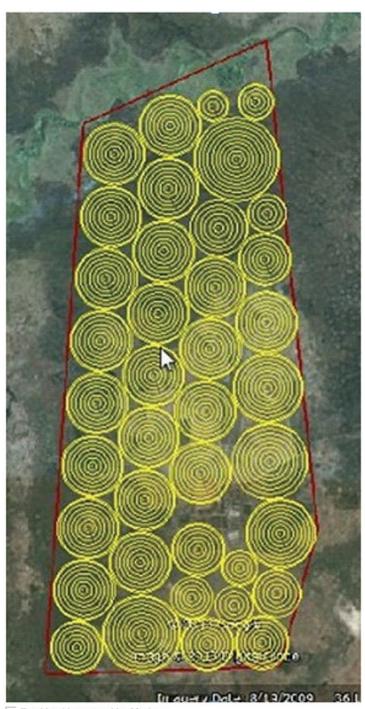
	TYPICAL PEAK WATER USE PER	TYPICAL PEAK WATER USE PERIODS								
Crop	Peak water use period ( days )	Crop	Peak water use period ( days )							
Alfalfa	100-165 (Depending on location)	Potatoes	45							
Corn	45	Barley	30							
Cotton	35-55 (Depending on location)	Beets	65							
Grass	155-200 (Depending on location)	Sorghum	45							
Wheat	30	Soybeans	50							

	WATI	ER REQUIRED & D	ATE OF ITTI	GATION		a (_ 39 13) (
Crop	Times of	Makes we size (for sex)	Date o	day)	<b>D</b> .:	
Сгор	irrigation Water required(mm)		First time	Second time	Last time	Duration
Wheat	1	97.6	9/16	9/22	9/27	12
	2	75.1	3/19	3/24	3/28	10
	3	82.6	4/16	4/21	4/25	10
	4	82.6	5/06	5/11	5/15	10
	1	82.6	3/27	3/30	4/03	8
Cotton	2	67.6	5/01	5/05	5/08	8
	3	67.6	6/20	6/24	6/27	8
	4	67.6	7/26	7/30	8/02	8
	1	90.1	4/12	4/17	4/21	10
	2	82.6	5/03	5/08	5/12	10
Grain	3	75.1	6/16	6/21	6/25	10
	4	75.1	7/10	7/15	7/19	10

		COOL Climate				Moderate Climate			Hot Climate				Desert Climate			
Crop		nes/Day /day	GPN	//Acre hr/ha	Inch	es/Day /day	GP	M/Acre /hr/ha		hes/Day n/day	GPI	M/Acre nr/ha		hes/Day n/day	GPM	1/Acre nr/ha
Alfalfa	0.24	6.10	4.5	2.52	0.27	6.86	5.1	2.86	0.34	8.64	6.4	3.58	0.45	11.43	8.5	4.76
Corn	0.23	5.84	4.3	2.41	0.26	6.60	4.9	2.74	0.32	8.13	6.0	3.36	0.45	11.43	8.5	4.76
Cotton	0.20	5.08	3.8	2.12	0.22	5.59	4.2	2.35	0.27	6.86	5.1	2.86	0.38	9.65	7.2	4.03
Grass	0.24	6.10	4.5	2.52	0.27	6.86	5.1	2.86	0.34	8.64	6.4	3.58	0.47	11.94	8.9	4.98
Wheat	0.20	5.08	3.8	2.12	0.23	5.84	4.3	2.41	0.29	7.37	5.5	3.64	0.36	9.14	6.8	3.81
Potatoes	0.20	5.08	3.8	2.12	0.25	6.35	4.7	2.63	0.34	8.64	6.4	3.58	0.47	11.94	8.9	4.98
Sugar Beets	0.20	5.08	3.8	2.12	0.23	5.84	4.3	2.41	0.30	7.62	5.7	3.19	0.43	10.92	8.1	4.54
Sorghum	0.21	5.33	4.0	2.24	0.26	6.60	4.9	2.74	0.32	8.13	6.0	3.36	0.45	11.43	8.5	4.76
Soybeans	0.22	5.58	4.2	2.35	0.23	5.84	4.3	2.41	0.30	7.62	5.7	3.19	0.45	11.43	8.5	4.76

MAJOR CROP ROOT DEPTH									
Crop	Major Root Depth(mm)	Crop	Major Root Depth(mm)	Crop	Major Root Depth(mm)	Crop	Major Root Depth(mm)		
Alfalfa	914-1829	Cucumbers	457-610	Onions	457	Peas	610		
Beans	610	Grain	610-762	Orchard	914-1524	Potatoes	610		
Beets	610-914	Sorghum	762	Pasture		Soybeans	610		
Cabbage	457-610	Grapes	914-1829	Grasses	457	Strawberries	304-457		
Carrots	457-610	Lettuce	305			Sweet	914		
				Pasture		Potatoes			
Corn	762	Melons	762-914	(With Clover)	610	Tobacco	610		
Cotton	1219			Peanuts	457	Tomatoes	304-610		

## Rainfine irrigation project report



☐ Total land is covered by 39 pivots.

## 21 pivots:

Seven 54.5m spans One 20.1m overhang

## 2 pivots:

Eight 54.5m spans One 20.1m overhang

## 1 pivot:

Nine 54.5m spans
One 20.1m overhang

## 4 pivots:

Six 54.5m spans
One 20.1m overhang

## 1 pivot:

Ten 54.5m spans One 6.7m overhang

## 1 pivot:

Six 61.3m spans One 6.7m overhang

### 1 pivot:

Three 61.3m spans One 20.1m overhang

## 1 pivot:

Six 54.5m spans
One 13.4m overhang

## 2 pivots:

Four 61.3m spans One 6.7m overhang

## 1 pivot:

Eight 61.3m spans One 6.7m overhang

## 1 pivot:

Five 54.5m spans One 6.7m overhang

## 1 pivot:

Five 61.3m spans One 6.7m overhang

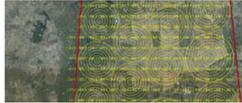
## 2 pivots:

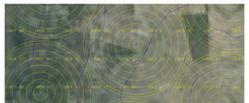
Four 54.5m spans One 13.4m overhang

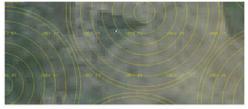


The elevation of this land, the biggest difference is about 40 meters.

The north is lower, the south is higher.



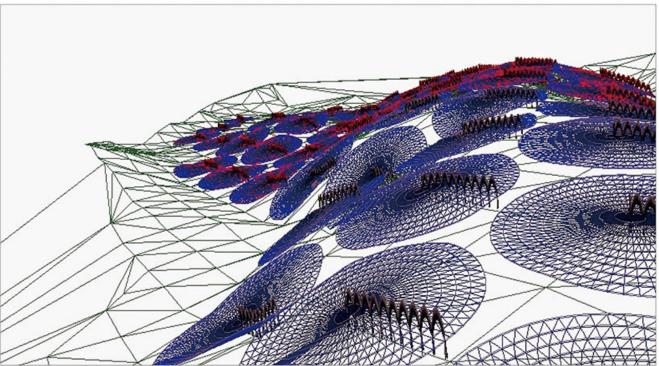




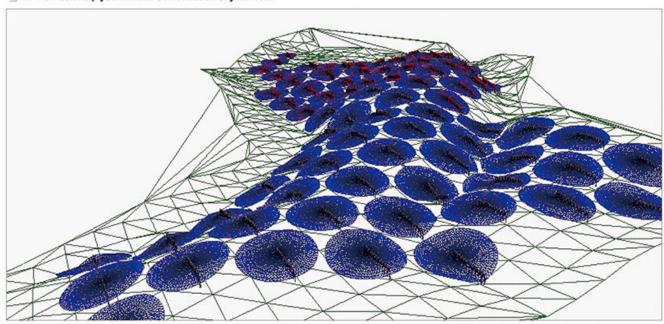
Total land is covered by 39 pivots.

Pictures showing elevation data.

# Rainfine irrigation project report



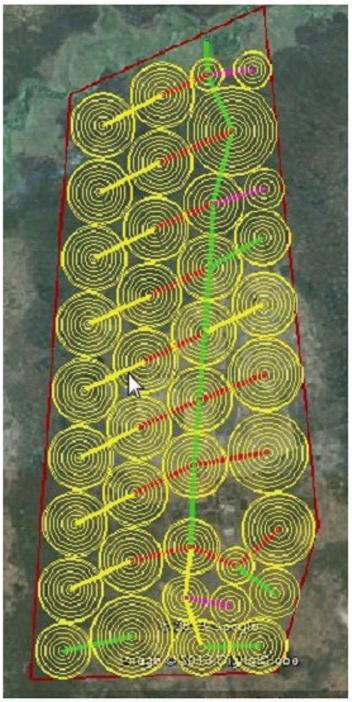
3D View can help you find more information of your field.



3D View can help you find more information of your field.

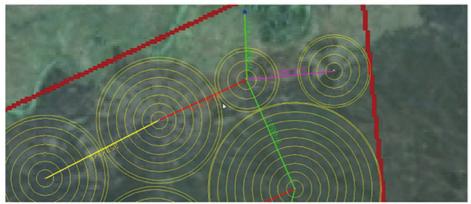
There is a high mountain in the middle of the land, we can carry the water up to the top of the mountain and the water with gravitation will flow back and help pumps to save power.

PVC pipeline design.
Hydraulic calculations was done
with software program.
There are some farm houses
where we can not place the pivots.



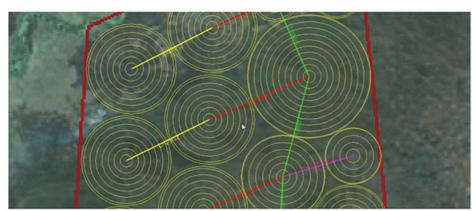
Pictures for showing elevation data.

# Rainfine irrigation project report



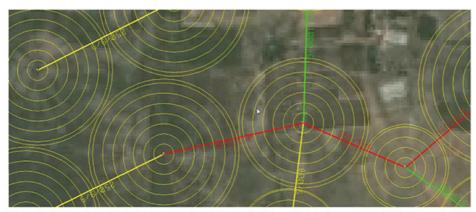
Pictures showing elevation data.

Pump station is placed close to river and PVC main line pipes are of 2 x 1000mm outside diameter (green pipes). The two PVC pipes are placed next to each other to supply enough water for all systems. The main supply pipes was designed to get water to higher point of land and then we can use also gravity flow to help pumps.



Pipes are designed in different colors so that we can see different sizes obviously. Same color means same diameter of PVC pipes. Program always uses outside diameter of pipes.

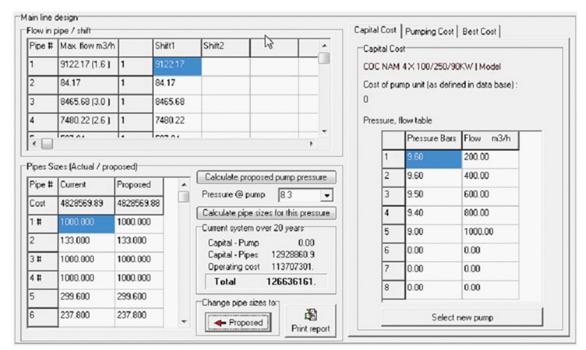
Pictures showing elevation data.



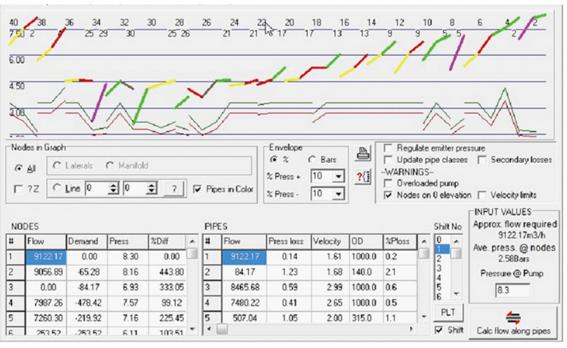
Pictures showing elevation data.

More pictures of different diameters. Here is also one red pipe with 355mm OD diameter.

Each pipe bears a number on its top showing size of the pipe required.



Pump station is placed close to river and PVC main line pipes are 2 x 1000mm outside diameter (green pipes). This two PVC pipes are placed next to each other to supply enough water for all system. The main supply pipes was design to get water to higher point of land and then we can use also gravity flow to help pumps.



Pipes have different colors on design so we can easy see different sizes. Same color mean same diameter of PVC pipe. Program always uses outside diameter of pipes.

## Rainfine irrigation project report

### Pivot details 1.

1 ~ 54.53	
2 ~ 54.53	
3 ~ 54.53	
4 ~ 54.53	
5 ~ 54.53	
6 ~ 54.53	
7 ~ 54.53	
8 ~ 54.53	
9 ~ 54.53	
10 ~ 54.53	
Total Spans ~	545.30 ~m
Overhang ~	6.70 ~m
Endgun ~	0.00 ~m
Area ~	957255.8 ~m2
Precipitation required	~ 12.00 ~ mm/day
Operating hours per o	day ~ 24.00
Operating efficiency	~ 100~ %
Required flow ~	478.42 ~m3/h

Speed of last tower 545.30 ~ 2.366 ~ m/minute

Time to complete full circle ~ 24.14 ~ hour

or ~ 1448 ~ minutes

Highest point on outside circle ~1046.18~8525369.36 ~E ~ 523956.79 ~N Highest point inside pivot area ~1046.40~8526028.15 ~E ~ 523956.47 ~N

Center point ~1045.05

Center coordinates ~ -523851.47 ~E ~ -8525911.2 ~N

Press Bar   Flow m3/h									
Pivot Center									
Top of pipe	3.8   478.4								
At tower #									
1	3.5   473.7								
2	3.2   459.4								
3	2.9   436.2								
4	2.7   403.1								
5	2.5   361.4								
6	2.1   309.5								
7	1.8   249.3								
8	1.6   178.6								
9	1.5   99.9								
10	1.5   10.3								

End of spans Main pipe pressure

1.51 Bars

Assuming even distribution on level surface and pressure regulators on outlets.

\_\_\_\_\_

Critical elevations in pivot area
Distance Elevation Pressure
Highest 163.6 1046.4 5.0
Lowest 163.6 1042.8 5.3

## Pupm details.

Pump station details:

Flow required: 9122.17m3/h Water pressure: 8.3bar Average

Pressure@ Nodes: 2.58 Bar

## Pipe & Node details.

NODES ----- Summary of total nodes

COC NAM 4 X 100/250/90KW Model Pump # 1

STD VALVE Model Valve # 39

-----

NODES ----- Detail of node sizes with OD pipe sizes

COC NAM 4 X 100/250/90KW Mode	l Pun	np	# 1 > E	End piece	1000.0	0
STD VALVE Model Valve	#	2 >	+ Piece	140.00	315.00	1000.00
1000.00						
STD VALVE Model Valve	#	3 >	End piece	140.00		
STD VALVE Model Valve	#	1 >	T Piece	315.00	1000.00	1000.00
STD VALVE Model Valve	#	8 >	Reducer	250.00	315.00	
STD VALVE Model Valve	#	9 >	End piece	250.00		
STD VALVE Model Valve	#	1 >	+ Piece	200.00	315.00	1000.00
1000.00						
STD VALVE Model Valve	#	4 >	End piece	200.00		
STD VALVE Model Valve	#	1 >	+ Piece	250.00	315.00	1000.00
1000.00						
STD VALVE Model Valve	#	2 >	+ Piece	315.00	315.00	1000.00
1000.00						
STD VALVE Model Valve	#	3 >	End piece	315.00		
STD VALVE Model Valve	#	1 >	+ Piece	315.00	355.00	800.00
1000.00						
STD VALVE Model Valve	#	1 >	T Piece	200.00	315.00	355.00
STD VALVE Model Valve	#	1 >	T Piece	140.00	800.00	800.00
STD VALVE Model Valve	#	1 >	T Piece	200.00	355.00	800.00
STD VALVE Model Valve	#	1 >	Reducer	200.00	355.00	

PIPES	OD	Total length m		
				(Slope Length)
MAIN PVC MAIN 140/9		140.00	#	1213.24
MAIN PVC MAIN 140/6		140.00	#	558.17
MAIN PVC MAIN 200/9		200.00	#	1609.10
MAIN PVC MAIN 200/6		200.00	#	1295.98
MAIN PVC MAIN 250/9		250.00	#	7402.95
MAIN PVC MAIN 315/9		315.00	#	8848.32
MAIN PVC MAIN 355/9		355.00	#	863.82
MAIN PVC MAIN 355/6		355.00	#	594.75
MAIN PVC MAIN 800		800.00	#	1273.47
MAIN PVC MAIN 1000		1000.0	#	10975.87
			Total	34635.68

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Total number of End Pieces 20
Total number of T Pieces 4
Total number of Reducers 9
Total number of + Pieces 7







Professional irrigation design service:

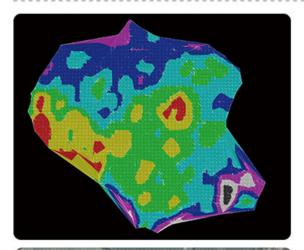
#### WHAT YOU OFFER TO US:

- The border line of your farm
- The location of water source
  From: Dam / Bore well / River / Canal / Others
- The border line of obstacles in your farm

  Obstacle: Tree / House / Electric power tower / Road / Others
- Water application needed (mm/24hr)

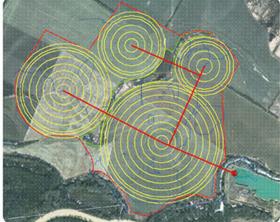
Please use *KML files* from *Google Earth* to show **1 2 3** as in the picture.





#### WHAT WE OFFER TO YOU:

- Topographic map
- Topographic map by colour
- 3D view of farm
- Irrigate shift arangement
- Irrigation equipment layout:
  Fixed center pivot / towable center pivot / lateral move
- Pipe network / fittings / valve design
- Pump or pump station system
- B Electric / diesel power solution
- Water system tested by computer
- Technical report for irrigation equipments
- Technical report for pipe lines
- Technical report for pumps
- Technical report for water hummer protection
- Equipment list
- Budget plan





Rainfine (Dalian)
Irrigation Co., Ltd.



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