


S. S. W. W.

DESCRIPTION OF PUMPING STATIONS
1921.

VOL. I

FRED. J. DIXON, M. INST. C.E.
ENGINEER.

SOUTH STAFFORDSHIRE WATERWORKS COMPANY.

PUMPING STATIONS.

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BRENDLEY BANK PUMPING STATION

situate near

RUGELEY in the County of STAFFORD.

S U M M A R Y

Total Engine Power at Station is equal to 1 1/4 million gallons per 24 hours at a maximum speed of 18 revolutions per minute.

At a normal speed of 14 revs. per minute, one engine at this Station will pump one million gallons per day.

TOTAL SPECIFIED HEAD equals 850 Feet.

C O S T S.

	<u>£.</u>	<u>s.</u>	<u>d.</u>
Land and Law Charges ...	1,037.	10.	9.
Boreholes ...	2,702.	15.	9.
Engine and Boiler Houses,...	5,816.	3.	4.
Cottage ...	410.	0.	0.
Engine and Boilers ...	8,478.	18.	9.
Filtration Plant ...	3,110.	19.	1.
Levelling, Fencing & Wharf ..	1,340.	6.	0.
<hr/>			
TOTAL COST -	£ 22,896.	13.	8.
<hr/> <hr/>			

Station Commenced - 1902.

Station Completed - 1914.

LAND. (3 Acres)

Purchased from C.M. Wolseley, Bart.
in January, 1905.

Level of B.H.F. above Ordnance Datum .. 253.99 Feet
Perpetual Ground Rent £ 36.0. 0.

CONTRACTORS.BOREHOLES.

Messrs Timmins of Runcorn ... 1902 - 1904

BUILDINGSEngine and Boiler Houses

T. Lowe & Sons, Burton-on-Trent. 1905 - 1907

Cottage ditto ditto 1907.

ENGINES.Engine and 2 Boilers.

Hathorn, Davey & Co, Leeds. 1907.

FILTRATION PLANT

Mather & Platt, Manchester. 1913 - 1914.

NOTE:- Boilers were constructed by
H & T Danks of Netherton.

C O S T S

	£.	s.	d.
<u>LAND.</u>			
Land and Law Charges ...	1,037.	10.	9.
<u>BOREHOLES.</u>			
No. 1. - Sinking Shaft & Boring,	1,692.	15.	9.
No. 2. - ditto ditto	1,010.	0.	0.
<u>BUILDINGS</u>			
Engine and Boiler Houses,	5,816.	3.	4.
Cottage	410.	0.	0.
Amount carried forward	£ 9,966.	9.	10.

COSTS (continued)

	£.	s.	d.
Amount brought for'd.	9,966.	9.	10.
<u>ENGINES</u>			
Engine and 2 Boilers ...	8,478.	18.	9.
<u>FILTRATION PLANT</u> ...	3,110.	19.	1.
<u>LEVELLING, &c.</u>			
Levelling, Fencing and Wharf,	1,340.	6.	0.
<hr/>			
<u>TOTAL COST</u>	£ 22,896.	13.	8.
<hr/>			

DESCRIPTION OF ENGINE HOUSE

Internal Measurement,	Length,	97 Feet
ditto	Width,	35 Feet
Height to top of Wall Plate,		38 Ft - 9 Ins.
Depth of Foundation from Floor)		16 Ft.
(Level.)		

DESCRIPTION OF BOILER HOUSE

Internal Measurement,	Length,	59 Ft. - 6 Ins.
ditto	Width,	35 Ft.

PARTICULARS OF NO. 1. ENGINE.BOREHOLES. 1 & 2.

Distance apart ...	...	20 Feet.
No. 1. Borehole.	30 In. dia. to a depth of	305 Ft - 4 Ins from E.H.F.
	18 In. ditto	511 Ft - 0 Ins do
No. 2. Borehole	33 In ditto	119 Ft - 0 Ins do
	30 In. ditto	308 Ft - 6 Ins do
	18 In. ditto	514 Ft - 0 Ins do

BOREHOLES (Continued)

Cast Iron Lining Tubes for suspending Rising Mains, concreted round Boreholes to a depth of about	...	41 Ft from E.H.F.
Inside diameter of Castings	...	3 Feet.
Thickness of Metal	...	1½ Ins.
Top of Boreholes	...	11 Feet do

ENGINE.

Horizontal Compound Tandem Surface
Condensing Rotative Pumping Engine.
Builder's Order Number - 6118.

CAPACITY

Net quantity for 24 hours at a speed
of 14 revolutions per minute = 1,000,000 galls.

Net quantity for 24 hours at a speed
of 18 revolutions per minute - 1,266,000 do

SPECIFIED HEAD

Maximum lift in Boreholes	...	300 Feet.
Ordinary Working Lift specified,		250 "
Head on Delivery Main, including friction)		550 "
TOTAL SPECIFIED HEAD		850 "
		===
Pump Horse Power at 18 Revs.	.	223.59
Maximum Speed per Minute	..	18 Revs.

RISING MAINS OF BOREHOLES.

Inside diameter of Mild Steel Tubing,		13 Ins.
Length of each	do Tube,	15 Feet.
Thickness	do do	½ In.

RISING MAIN OF BOREHOLES (Continued)

Diameter of Couplings outside	...	15 $\frac{1}{2}$	Ins.
Length	ditto	9	"

Each Rising Main consists of 18
Tubes and 17 Couplings. Tubes
and Couplings screwed 8 threads
per inch.

One Suction Tube to each Rising Main, (inside diameter)		12	Ins.
One ditto Length	...	13	Feet
One ditto Thickness	...	$\frac{1}{2}$	Inch.

Joints between Tubes made of $\frac{5}{16}$
inch dia. Gutta Percha Beats.

CAST IRON WORKING BARRELS.

Diameter	...	...	...	12	Ins.
Length	...	...	...	7 Ft -10	Ins.
Thickness	...	...	...	1 $\frac{1}{2}$	Ins.

Both ends of barrels screwed to
receive Rising Main and Suction
Valve Box.

SUCTION VALVE BOX.

Diameter	...	...	...	14 $\frac{1}{2}$	Ins.
Length	...	...	...	5 $\frac{1}{2}$	Feet
Thickness	...	...	...	1 $\frac{1}{2}$	Ins.

Both ends of Valve Box screwed
internally to receive Working
Barrel and Suction Tube.

CAST IRON STRAINER.

Inside Diameter	...	...	12	Ins.
Length	...	...	7	Ft. - 3 Ins.
Bottom Flange	...	...	26	Ins.

Suction Valve Box fitted with
Gunmetal Seat for Suction Valve
or Clack.

BOREHOLE PUMPS.

Single-Acting Pumps actuated by
Compensating Levers and Rods from
Engine Crosshead.

BOREHOLE BUCKETS AND SUCTION VALVE

Cast Iron Double-Beat with
Gutta Percha Beats.

Diameter of Buckets	...	...	12	Ins.
Stroke	do	...	5	Ft - 6 Ins.
Free Lift on Valve	do	...	$\frac{3}{4}$	In.
Diameter, Borehole Suction Valves	.		11 $\frac{1}{2}$	Ins.
Free Lift on	ditto	...	$\frac{3}{4}$	"
Diameter, Borehole Rods	...	...	3	"
"	Top do	...	4	"
No. Borehole Rod Guides in one lift			18	
Dia. Borehole Guides	ditto		12 $\frac{1}{2}$	Ins.
Borehole Rod Couplings	...	...		Tapered.
Diameter, Steam Cylinders, H.P.	...		28	Ins.
ditto	L.P.	...	54	"
Stroke of Engine	...	...	5	Feet.

BORING BUCKETS & SUCTION VALVE Continued.

Diameter, Piston Rod, H.P. Front End,	5 $\frac{1}{2}$	Ins.
" do Centre,	6 $\frac{1}{2}$	"
" do L.P. Back End,	4	"

Piston Rings - Mather & Platt's Rings
and Springs.

Piston Rod Packings. - United States Metallic
Packing Co., Bradford.

<u>Maker's No. on H.P. Packing</u>	-	52058
ditto L.P. do	-	52060

ENGINE VALVE GEAR.

Ordinary Slide Valves fitted with
Meyer Cut Off. Adjustable by hand.

Diameter, Connecting Rod Crank Pin,	10	Ins.
" ditto Crosshead Pin)	6 $\frac{1}{2}$	"
" Crank Shaft Bearings,	11	Ins.

FLYWHEEL. (CAST IRON).

Diameter	...	...	...	24	Feet
Width of Rim	...	...	...	13	Ins.
Internal diameter of Boss	...	...	...	15	"

AIR PUMP.

Single-Acting, working off disc
on Crank Shaft.

Diameter,	...	...	...	20	Ins.
Stroke	...	...	...	2	Ft - 9 Ins.
<u>Valves</u>	-	<u>India-Rubber.</u>			
Foot Valves	...	...	...	15	Ins dia.
Bucket do	...	...	...	16 $\frac{3}{4}$	" "
Packing round Air Pump Bucket,	...	...	...	$\frac{5}{8}$	" Hemp.
Diameter, Bucket Rod	...	...	...	2 $\frac{3}{4}$	"

AIR PUMP (Continued)

Diameter of Inlet	...	...	7	Ins.
"	Outlet	...	4	"

FORCE PUMP.Double-Acting Piston Pump drivenby L.P. Piston Tail Rod.

Diameter, F.P. Piston	...	...	12 $\frac{1}{2}$	Ins.
Stroke	do	...	5	Ft.
Diameter	do	Rod (Front End only)	4	Ins.
Gallons discharged per double stroke,			52.55	
Multiplier given to Foreman	...		52	
Excess of discharge of Borehole Pumps over Force Pumps	...		2.54%	

FORCE PUMP VALVES

Phosphor Bronze Valves and Seats
of Multi-Annular Type, beating
Metal to Metal.

Number of Suction Valves in all	...	38	
"	Delivery Valves do	...	38
Diameter of Screwed part of Valve)		4	Ins
Seats)			(Gas)

CONDENSER.Open Type with Tubesexpanded into Tube Plates.Condenser placed in Force PumpSuction Tank.

Cooling Surface	...	...	550	Sq. Ft.
Number of Tubes	...	...	265	
Diameter, ordinary Tubes	...	(Ext)	1	In.
Length	do	...	8	Ft - 1 $\frac{1}{2}$ In
Thickness	do	...	15	B.W.G.

CONDENSER (Continued)

Number of Stay Tubes	...	0
Diameter, Exhaust Inlet,	...	12 Ins.
" Condensate Outlet,		7 "
Pitch of Tubes	... ..	1½ "
Diameter, Tube Plates	...	2 Ft - 9½ Ins
Thickness do	...	1 In.
Distance apart over Tube Plates,		7 Ft - 11 Ins

AIR VESSEL. (MILD STEEL)

Total height inside	...	17 Ft - 10 Ins
Diameter "	...	2 Ft.
Height above Branches	...	16½ Ft.
Capacity above do	...	52 C. Ft.
Thickness, Metal	...	½ In.
Working pressure per square inch,		240 Lbs.
Total Capacity	...	56 C. Ft.

OVERHEAD TRAVELLING CRANE

Made by R.C.Gibbons & Co, Birmingham.

Load	... ..	15 Tons.
Span	... ..	34 Feet.
Height from E.H.F. to top of Crane)	20 " - 9 Ins.	
	Rail)	

WINCH.

Horizontal Steam Type, made by

J.H.Wilson & Co., Liverpool.

Diameter, Cylinders	...	7 Ins.
Stroke	...	12 "
Diameter, Wire Rope on Barrel,		1 "
" Barrel,	...	18 "
Length do	...	21½ "

WINCH (Continued)

Diameter, Steam Inlet	...	1 $\frac{1}{2}$	Ins.
" Exhaust,	...	2 $\frac{1}{2}$	"

BARRING ENGINE (Double Geared)

Cylinders (Two) made by -
Hick Hargreaves, Bolton.

Diameter,	...	...	6	Ins.
Stroke,	...	...	7 $\frac{1}{2}$	"

STEAM SEPARATOR

Made by Holden & Brookes Ltd.

Pattern Number "A"

Diameter of Inlet and Outlet,	5	Ins.
Tested Pressure, per sq. inch,	150	Lbs.

AIR COMPRESSOR (Single Stage)

Made by The Westinghouse Brake
Company Limited, London.

Size	...	...	..	8" / 4"
Class	...	...	..	F.
Diameter, Steam Inlet	..	..	..	1 In.
" Exhaust Outlet	..	..	..	1 $\frac{1}{2}$ "
" Air Delivery,	..	..	..	$\frac{3}{4}$ "
" Steam Cylinder	..	..	..	8 "

Maker's Number on Compressor

39695.

Number of London Works

14314.

STEAM REHEATER. (Between H.P. and L.P. Cylinders)

Diameter, Reheater Receiver	...	20 $\frac{1}{2}$ Ins.
Length ditto	...	8 Ft - 3 $\frac{1}{2}$ Ins
Number, Brass Tubes	...	10
Diameter do (External)	...	1 In.
Thickness do	...	16 B.W.G.
Heating Surface	...	31 Sq. Ft.
Capacity	...	19 Cu. Feet.

AIR CHARGER ON AIR VESSEL.

Wipperman and Lewis type. Made by
Hathorn, Davey & Co. of Leeds.

Diameter, Copper Delivery Pipe,	...	$\frac{11}{16}$ In. Ext.
" Suction Pipe	...	1 $\frac{1}{8}$ In.

SAFETY TRIP GEAR ON ENGINE

Diameter of Valve	...	5 $\frac{1}{2}$ Ins.
Cast Iron Weight,	...	210 Lbs.

TWO LANCASHIRE STEAM BOILERS

Diameter	...	7 Ft - 6 Ins.
Length	...	30 Ft.
Thickness, Shell Plate ..	...	$\frac{9}{16}$ In.
Diameter Internal Flues (Front End)	...	3 Feet
ditto (Back End)	...	2 Ft - 6 Ins.
Thickness, End Plates ..	...	$\frac{5}{8}$ In.
Thickness, Flues,	...	- - -
Front End Section ..	...	$\frac{1}{2}$ In.
Intermediate " ...	...	$\frac{7}{16}$ In.
Back End " ...	...	$\frac{1}{2}$ In.
Manhole - Mc.Neil type.		
do Size	...	16 In X 12 In.
Total Heating Surface ..	...	1000 Sq. Ft.

STEAM MOUNTINGS ON BOILERSAll of Hopkinson's make andSpecification No. A.1903

One Figure 1000 Patent "Triad" Junction Valve)	6 Ins Dia.
One Figure 7 Patent "Dnad" Safety Valve for High Steam and Low Water.	
One Figure 20 Patent Dead Weight Safety Valve for Steam only ...	3 Ins Dia.
One Figure 2540 Parallel Slide Blow Off Valve ...	2½ Ins Dia.
One Figure 1320 Patent Accessible Check Feed Valve ...	2½ Ins Dia.
Two Figures 6440 "Absolute" Water Gauges, Centre of Top and Bottom Arms ...	¾ do 18 Ins.
One Figure 4010 Steam Gauge Dial ...	10 Ins Dia.
No. Fusible Plugs in each Boiler ...	2
Working pressure per square inch ...	100 Lbs.
<u>FEED PUMPS</u> ...	1.
<u>Double Ram, made by J. Cameron Ltd, Manchester.</u>	
Diameter of Ram ...	3 Ins. 3ws
Stroke do ...	3 " 12 "
Diameter, Steam Cylinders ...	5 " 4½ "
Maker's Number on Pump ...	17941.

ONE . VERTICAL "TIPON." TO RED

CAST IRON FEED TANK.Fitted with Berryman Heater, Size "F"Made by J. Wright & Co. of Tipton.

Heating Surface of Heater	...	25 Sq. Feet.
Size, Feed Water Tank	...	5 Ft - 4 Ins X 3 Ft - 4 Ins X 4 Ft Deep.

FILTRATION PLANT*per Nathan & Platt*Mechanical Filter, installed - 1913 - 1914

Number	...	6
Capacity of each Filter per day,		120,000 Gallons.
Diameter, each Filter,	...	8 Feet,

Filters made of Mild Steel.

Maximum working pressure of each Filter per square inch	...	100 Lbs.
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LUBRICATOR ON MAIN ENGINE FOR H.P. AND L.P. CYLINDERSSight Feed Type made by Hunt & Mitton,
Birmingham.Name stamped on Lubricator - Killingbeck.OFFICIAL DUTY TRIAL OF ENGINE - 31ST OCTOBER, 1907.

Duration of Trial	...	12 hours.
Mean Delivery Pressure per sq. in.		215 Lbs.
Level of Water in Boreholes from) E.H.F.)		245.6 Feet
Total Indicated Horse Power	..	182.1
Total Water Pumped (Rate per 24) hours and 5% Slip allowed)		929,072 gallons.
Average Total Head against Pump,		746 Feet.
Average Pump Horse Power	...	153.5
Mechanical Efficiency	...	84.3%

TRIAL OF ENGINE (Continued)

Duty per 1120 Lbs of Steam (Slip neglected) 125,000,000
Ft. Lbs.

Evaporation per lb. of Slack ... 6.22 Lbs.

Duty per cwt. of Slack ... 71,500,000
Ft. Lbs.

Specified duty was to be not less than
100,000,000 ft. lbs. per 1120 lbs
of Steam at 100 lbs. pressure.

The trial to be at full power.

Specified P.H.P. at 14 revolutions per
minute) 177

Height of Pumping Pressure Gauge above
E.H.F. ... 5 Feet.
