



Diversified Enviro Products & Services, Inc.

309 Smith Lane
Franklin, LA 70538
(337) 828-3758 Phone
(337) 907-6427 Fax

ERM

Project Location – Hero Lands Property, Plaquemines Parish, LA
Re: Remediation & Restoration
8-28-2020

Diversified Enviro Products & Services, Inc. (DEPS) – herein provides a cost estimate to ERM for all required **Remediation & Site Restoration Activities** at the Hero Lands Property located in Plaquemines Parish, LA.

If a revision to the scope of work outlined herein is appropriate, DEPS will submit a revised scope and budget.

Base Bid Scope of Work – Remediation, Trucking, Disposal, Restoration

Work Scope Activities:

- 1. Pre-Job Deliverables / Site Visits..... \$2,000.00
- 2. Mobilization / Site Prep (1 Day).....\$5,338.00
- 3. Remediation / Loading / Trucking / Disposal (42 Days).....\$944,649.00
- 4. Site Restoration (19 Days).....\$250,652.00
- 5. Demobilization (1 Day).....\$5,018.00

Total Estimated Job Cost\$1,207,657.00

OFFSITE AREA (7 DAYS).....\$75,000.00

***Note:**

- a) See backup documentation for line item breakdown of cost per job scope and notes pertaining to each scope below individual breakdown.

DEPS would like to thank you for the opportunity to provide this cost estimate for the aforementioned work. All the work is to be performed in accordance with all applicable local, state, and federal regulations. Please feel free to call us with any questions, and once again, thank you for the opportunity.

Kind Regards,

Corey Gauthreaux, RSO
Diversified Enviro Products & Services, Inc.
corev.gauthreaux@depsenviro.com
504-415-5478 cell

ERM

Hero Lands Site Restoration Project

	Days	Total
Pre-Job Deliverables / Site Visits		\$2,000.00
Project Mobilization-Site Prep <i>Cost includes mobilization of crew & equipment, site setup, onsite meeting, delivery of heavy equipment</i>	1	\$5,338.00
Remediation / Loading / Trucking / Disposal <i>Cost includes labor, equipment, materials necessary to excavate, transport, dispose and approximately 10,320 cu yds / 10,320 tons of impacted soils</i>	42	\$944,649.00
Site Restoration <i>Cost includes labor, equipment, materials necessary to haul in 11,180 cu yds of fill material and perform site restoration activities</i>	19	\$250,652.00
Demob <i>Cost includes de-mobilization of crew & equipment</i>	1	\$5,018.00
TOTALS	63	\$1,207,657.00

ERM
Hero Lands Site Restoration Project

	Estimated Quantity	Unit	Unit Cost	Extended Cost
Line Item 1 - Mobilization-Site Prep				
Estimated time to completion- 1 work day				
Labor				
Enviro Proj Manager	13	\$/hr	\$ 60.00	\$ 780.00
Env Tech(3@\$40/hr)	12	\$/hr	\$ 120.00	\$ 1,440.00
			Subtotal	\$ 2,220.00
Equipment				
Crew Pick-up (\$120/Truck/day)(2 onsite)	1	\$/day/trk	\$ 240.00	\$ 240.00
Site Office w/generator	1	\$/day	\$ 193.00	\$ 193.00
Field Support Package	1	\$/day	\$ 15.00	\$ 15.00
			Subtotal	\$ 448.00
Other				
Per Diem/Meals (\$50/man/day)(4 onsite)	1	\$/day	\$ 200.00	\$ 200.00
Per Diem/Lodging (\$80/man/day)(4 onsite)	1	\$/day	\$ 320.00	\$ 320.00
Mob of Cat 320 Excavator	1	\$/load	\$ 330.00	\$ 330.00
Mob of Cat 930 Wheel Loader	2	\$/load	\$ 330.00	\$ 660.00
Mob of Cat D6 Dozer	2	\$/load	\$ 330.00	\$ 660.00
Misc. Supplies	1	\$/job	\$ 500.00	\$ 500.00
			Subtotal	\$ 2,670.00
SUBTOTAL ITEM 1				\$ 5,338.00
TOTAL ESTIMATED JOB COST				\$ 5,338.00

NOTES:

ERM
Hero Lands Site Restoration Project

	Estimated Quantity	Unit	Unit Cost	Extended Cost
Line Item 2 - Excavation, Transport, Disposal				
Estimated time to completion- 42 work days				
Labor				
Enviro Proj Manager	546	\$/hr	\$ 60.00	\$ 32,760.00
Equip Operator (Excavation Days)	408	\$/hr	\$ 45.00	\$ 18,360.00
Equip Operator(2@\$45/hr)	504	\$/hr	\$ 90.00	\$ 45,360.00
Env Tech (Waste Shipping Days)	456	\$/hr	\$ 40.00	\$ 18,240.00
			Subtotal	\$ 114,720.00
Equipment				
Crew Pick-up (\$120/Truck/day)(2 onsite)	42	\$/day/trk	\$ 240.00	\$ 10,080.00
Site Office w/generator	42	\$/day	\$ 193.00	\$ 8,106.00
Field Support Package	42	\$/day	\$ 15.00	\$ 630.00
Cat 320 Excavator	34	\$/day	\$ 660.00	\$ 22,440.00
Cat 930 Wheel Loader (2@\$576/day/loader)	42	\$/day	\$ 1,152.00	\$ 48,384.00
			Subtotal	\$ 89,640.00
Other				
Per Diem/Meals-Lodging (\$130/man/day)(5-man crew days)	30	\$/day	\$ 650.00	\$ 19,500.00
Per Diem/Meals-Lodging (\$130/man/day)(4 man crew days)	12	\$/day	\$ 520.00	\$ 6,240.00
Disposal (Republic-Colonial Landfill)	10,320	\$/ton	\$ 41.75	\$ 430,860.00
Trucking of Impacted Material (Stallion Construction)	38	\$/day	\$ 6,710.00	\$ 254,980.00
Stallion Service Truck	38	\$/day	\$ 100.00	\$ 3,800.00
Liners	573	\$/liner	\$ 33.00	\$ 18,909.00
Misc. Supplies	1	\$/job	\$ 1,000.00	\$ 1,000.00
Diesel	2,000	\$/gal	\$ 2.50	\$ 5,000.00
			Subtotal	\$ 740,289.00
SUBTOTAL ITEM 1				\$ 944,649.00
TOTAL ESTIMATED JOB COST				\$ 944,649.00

NOTES:

1- Trucking based on Tare weight of 17 tons/truck

2- Total loads based on 18 tons/load

3- Disposal Cost per ton includes 10% Fuel Surcharge from Colonial

4- Trucking Cost based on 5 trucks @ 3/loads/day/truck

5- SST Box and pallet scale will be utilized to weigh one cu yd of soil to confirm payload capacity per load

6- 20% Fluff factor added to soil volume; Estimate based on 1 ton/cu yd

ERM
Hero Lands Site Restoration Project

	Estimated Quantity	Unit	Unit Cost	Extended Cost
Line Item 3 - Site Restoration				
Estimated time to completion- 19 work days				
Labor				
Enviro Proj Manager	247	\$/hr	\$ 60.00	\$ 14,820.00
Equip Operator(2@\$45/hr)	228	\$/hr	\$ 90.00	\$ 20,520.00
Env Tech	228	\$/hr	\$ 40.00	\$ 9,120.00
			Subtotal	\$ 44,460.00
Equipment				
Crew Pick-up (\$120/Truck/day)(2 onsite)	19	\$/day/trk	\$ 240.00	\$ 4,560.00
Site Office w/generator	19	\$/day	\$ 193.00	\$ 3,667.00
Field Support Package	19	\$/day	\$ 15.00	\$ 285.00
Side by Side ATV	4	\$/day	\$ 75.00	\$ 300.00
Seed Spreader	4	\$/day	\$ 50.00	\$ 200.00
D6 Dozer (2@\$720/day/machine)	19	\$/day	\$ 1,440.00	\$ 27,360.00
			Subtotal	\$ 36,372.00
Other				
Per Diem/Meals (\$50/man/day)(4 onsite)	19	\$/day	\$ 200.00	\$ 3,800.00
Per Diem/Lodging (\$80/man/day)(4 onsite)	19	\$/day	\$ 320.00	\$ 6,080.00
Fill Dirt-(Material & Freight)	11,180	\$/yd	\$ 14.00	\$ 156,520.00
Full 29B Analytical (Backfill Source Material)	1	\$/sample	\$ 420.00	\$ 420.00
Misc. Supplies	1	\$/job	\$ 1,000.00	\$ 1,000.00
Diesel	800	\$/gal	\$ 2.50	\$ 2,000.00
			Subtotal	\$ 169,820.00
SUBTOTAL ITEM 1				\$ 250,652.00
TOTAL ESTIMATED JOB COST				\$ 250,652.00

NOTES:

1- 30% Fluff Factor computed in fill material yardage on top off in place volume

ERM
Hero Lands Site Restoration Project

	Estimated Quantity	Unit	Unit Cost	Extended Cost
Line Item 4 - Demobilization				
Estimated time to completion- 1 work day				
Labor				
Enviro Proj Manager	13	\$/hr	\$ 60.00	\$ 780.00
Env Tech (3@\$40/hr/man)	12	\$/hr	\$ 120.00	\$ 1,440.00
			Subtotal	\$ 2,220.00
Equipment				
Crew Pick-up (\$120/Truck/day)(2 onsite)	1	\$/day/trk	\$ 240.00	\$ 240.00
Site Office w/generator	1	\$/day	\$ 193.00	\$ 193.00
Field Support Package	1	\$/day	\$ 15.00	\$ 15.00
			Subtotal	\$ 448.00
Other				
Per Diem/Meals (\$50/man/day)(4 onsite)	1	\$/day	\$ 200.00	\$ 200.00
Demob of Cat 320 Excavator	1	\$/load	\$ 330.00	\$ 330.00
Demob of 930 Wheel Loader	2	\$/load	\$ 330.00	\$ 660.00
Demob of Cat D6 Dozer	2	\$/load	\$ 330.00	\$ 660.00
Misc. Supplies	1	\$/job	\$ 500.00	\$ 500.00
			Subtotal	\$ 2,350.00
SUBTOTAL ITEM 1				\$ 5,018.00
TOTAL ESTIMATED JOB COST				\$ 5,018.00

NOTES:



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Project Location – Hero Lands Property, Plaquemines Parish, LA
Re: Remediation & Restoration
8-28-2020

Diversified Enviro Products & Services, Inc. (DEPS) – herein provides a cost estimate to ERM for all required **Onsite Soil Treatment Activities** at the Hero Lands Property located in Plaquemines Parish, LA.

If a revision to the scope of work outlined herein is appropriate, DEPS will submit a revised scope and budget.

Base Bid Scope of Work – Excavation / Blending / Backfill

Work Scope Activities:

- 1. Pre-Job Deliverables / Site Visits..... \$2,000.00
- 2. Mobilization / Site Prep (1 Day).....\$3,980.00
- 3. Remediation / Blending / Backfill (128 Days).....\$611,120.00
- 4. Demobilization (1 Day).....\$3,740.00

Total Estimated Job Cost\$620,840.00

***Note:**

- a) See backup documentation for line item breakdown of cost per task.

DEPS would like to thank you for the opportunity to provide this cost estimate for the aforementioned work. All the work is to be performed in accordance with all applicable local, state, and federal regulations. Please feel free to call us with any questions, and once again, thank you for the opportunity.

Kind Regards,

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Hero Lands Site Restoration Project

	Days	Total
Pre-Job Deliverables / Site Visits		\$2,000.00
Project Mobilization-Site Prep <i>Cost includes mobilization of crew & equipment, site setup, onsite meeting, delivery of heavy equipment</i>	1	\$3,980.00
Land Treatment <i>Cost includes labor, equipment, materials necessary to excavate, add amendments, and backfill impacted soils over an 16 acre tract to a depth of 2 feet</i>	128	\$611,120.00
Demob <i>Cost includes de-mobilization of crew & equipment</i>	1	\$3,740.00
TOTALS	130	\$620,840.00

ERM
Hero Lands Site Restoration Project

	Estimated Quantity	Unit	Unit Cost	Extended Cost
Line Item 1 - Mobilization-Site Prep				
Estimated time to completion- 1 work day				
Labor				
Enviro Proj Manager	13	\$/hr	\$ 60.00	\$ 780.00
Env Tech(2@\$40/hr)	12	\$/hr	\$ 80.00	\$ 960.00
			Subtotal	\$ 1,740.00
Equipment				
Crew Pick-up (\$120/Truck/day)(2 onsite)	1	\$/day/trk	\$ 240.00	\$ 240.00
			Subtotal	\$ 240.00
Other				
Per Diem/Meals (\$50/man/day)(3 onsite)	1	\$/day	\$ 150.00	\$ 150.00
Per Diem/Lodging (\$80/man/day)(3 onsite)	1	\$/day	\$ 240.00	\$ 240.00
Mob of Cat 320 Excavator	1	\$/load	\$ 330.00	\$ 330.00
Mob of 100HP Tractor w/ disc	1	\$/load	\$ 450.00	\$ 450.00
Mob of Cat D6 Dozer	1	\$/load	\$ 330.00	\$ 330.00
Misc. Supplies	1	\$/job	\$ 500.00	\$ 500.00
			Subtotal	\$ 2,000.00
SUBTOTAL ITEM 1				\$ 3,980.00
TOTAL ESTIMATED JOB COST				\$ 3,980.00

NOTES:

ERM
Hero Lands Site Restoration Project

	Estimated Quantity	Unit	Unit Cost	Extended Cost
Line Item 2 - Soil Treatment				
Estimated time to completion- 128 work days				
Labor				
Enviro Proj Manager	1,664	\$/hr	\$ 60.00	\$ 99,840.00
Equip Operator (2@\$45/hr/man)	1,536	\$/hr	\$ 90.00	\$ 138,240.00
			Subtotal	\$ 238,080.00
Equipment				
Crew Pick-up (\$120/Truck/day)(2 onsite)	128	\$/day/trk	\$ 240.00	\$ 30,720.00
100 HP John Deer Tractor	74	\$/day	\$ 420.00	\$ 31,080.00
15' Disc/Chopper	36	\$/day	\$ 150.00	\$ 5,400.00
500# PTO Seed Spreader	36	\$/day	\$ 50.00	\$ 1,800.00
Hay Cart / Blower	36	\$/day	\$ 75.00	\$ 2,700.00
Cat 320 Excavator	96	\$/day	\$ 660.00	\$ 63,360.00
Cat D6 Dozer	128	\$/day	\$ 720.00	\$ 92,160.00
			Subtotal	\$ 227,220.00
Other				
Per Diem/Meals (\$50/man/day)(3 onsite)	128	\$/day	\$ 150.00	\$ 19,200.00
Per Diem/Lodging (\$80/man/day)(3 onsite)	128	\$/day	\$ 240.00	\$ 30,720.00
Gypsum	160	\$/ton	\$ 400.00	\$ 64,000.00
Freight of Gypsum	8	\$/load	\$ 800.00	\$ 6,400.00
Hay / Fertilizer	16	\$/acre	\$ 500.00	\$ 8,000.00
Misc. Supplies	1	\$/job	\$ 5,000.00	\$ 5,000.00
Diesel	5,000	\$/gal	\$ 2.50	\$ 12,500.00
			Subtotal	\$ 145,820.00
SUBTOTAL ITEM 1				\$ 611,120.00
TOTAL ESTIMATED JOB COST				\$ 611,120.00

NOTES:

ERM
Hero Lands Site Restoration Project

	Estimated Quantity	Unit	Unit Cost	Extended Cost
Line Item 3 - Demobilization				
Estimated time to completion- 1 work day				
Labor				
Enviro Proj Manager	13	\$/hr	\$ 60.00	\$ 780.00
Env Tech (2@\$40/hr/man)	12	\$/hr	\$ 80.00	\$ 960.00
			Subtotal	\$ 1,740.00
Equipment				
Crew Pick-up (\$120/Truck/day)(2 onsite)	1	\$/day/trk	\$ 240.00	\$ 240.00
			Subtotal	\$ 240.00
Other				
Per Diem/Meals (\$50/man/day)(3 onsite)	1	\$/day	\$ 150.00	\$ 150.00
Demob of Cat 320 Excavator	1	\$/load	\$ 330.00	\$ 330.00
Demob of 100 Hp Tractor w/disc	1	\$/load	\$ 450.00	\$ 450.00
Demob of Cat D6 Dozer	1	\$/load	\$ 330.00	\$ 330.00
Misc. Supplies	1	\$/job	\$ 500.00	\$ 500.00
			Subtotal	\$ 1,760.00
SUBTOTAL ITEM 1				\$ 3,740.00
TOTAL ESTIMATED JOB COST				\$ 3,740.00

NOTES:

Assume all 20 acres on Hero in
Bermuda grass / Ryegrass pasture

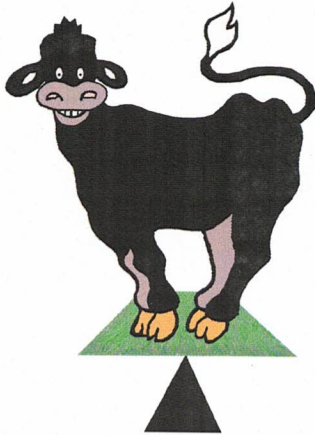
Assume 14 cows (1300 lbs./cow) on
20 acres or 1.4 acres/cow

Assume 15 gallons of H₂O/cow/day
14 Cows X 15 gallons = 210 Gals./Day

76650 Gals./year

How many animals should be on your pasture?

If you have a limited amount of land but a flexible herd size, you probably want to know **the maximum number of animals** that you can graze on your pasture.



How many acres of pasture do your animals need?

If you have a lot of land but you want to keep a fixed number of livestock, you probably want to know **the minimum amount of land** your animals need to graze.

Finding the right balance between your herd size and your available forage is essential to good grazing management whether you are using a continuous or rotational grazing system.

To answer the questions above, you'll need to know:

- the length of your grazing season in days OR you can figure how much you will need for the whole year by using 365 days.
- the average weight of one of your animals
- the total number of acres available for grazing (many people also include their hayland)
- the average yield of your pasture per acre (Use your own yield figures if you have them. If not, you can get average yield estimates from your local NRCS Office.
- The daily utilization rate for livestock. This is always the same number, **.04**, or 4%. This figure is used because livestock need to have 4% of their weight in forage each day (2.5-3% intake, .5 trampling loss and .5-1% buffer).

EXAMPLE FARM

Beefy Acres is a cow/calf operation located in the Southeast.

- We are going to try to figure out how much we will need the whole year (**365 days**)
- The average weight of one beef cow/calf is **1200 lb**
- We have a total of **20** acres of pasture
- We have 10 ac of bermudagrass and ryegrass with an average yield of **11,500 lb/ac/yr**
- We have 10 ac of fescue with an average yield of **7,500 lb/ac/yr**
- Together, the average yield of both pastures is **9,500 lb/ac**

You may have heard a rule-of-thumb is that it takes 1.5 to 2 acres to feed a cow calf pair for 12 months. That means we should be able to have 10 to 13 cows.

Let's see how this rule-of-thumb holds up.

Balancing your Animals with your Forage

Let's start with how many animals should be on our example farm.

$$\begin{aligned} \text{Total Number of Animals} &= \frac{(\text{total acreage } 20 \text{ ac}) \times (\text{average yield per acre } 9,500 \text{ lb/ac})}{(.04) \times (\text{average animal weight } 1200 \text{ lb}) \times (\text{grazing days } 365)} \\ &= \frac{(20) \times (9,500)}{(.04) \times (1200) \times (365)} = \frac{190,000}{17,520} = \mathbf{11 \text{ animals}} \end{aligned}$$

This is the maximum number of animals. You can always stock less animals.

Now let's figure out the minimum amount of pasture our animals would need. Let's use the 11 beef cows from above.

$$\begin{aligned} \text{Acres of Pasture Needed} &= \frac{(\text{animals } 11) \times (\text{average animal weight } 1200 \text{ lb}) \times (.04) \times (\text{grazing days } 365)}{(\text{average yield per acre } 9,500 \text{ lb})} \\ &= \frac{(11) \times (1200 \text{ lb}) \times (.04) \times (365)}{(9,500 \text{ lb/ac})} = \frac{192,720}{9,500} = \mathbf{20 \text{ acres}} \end{aligned}$$

This is the minimum amount of land. You can always use more than the minimum.

It looks like our rule-of-thumb held up pretty good, 11 cows on 20 acres, is 1.8 acres per cow. We have enough forage to feed our cows for the whole year. These figures give you a good estimate and are a great place to start.

Unfortunately, grass does not grow in equal amounts the entire year. So, we'll need to break this down on a month-by-month basis. To do this, you'll need to know the growth pattern and rate of your forage for your area. You can get the growth rates for your area from your local NRCS office or use your own numbers if you have them. Let's look at the example monthly growth rate of our pastures below.

Table 1: Monthly Growth Rate in lb/ac

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
bermuda/rye 11,500/yr	62	112	1080	1140	1674	1410	2015	1798	930	589	570	120
fescue 7,500/yr	93	410	1085	1500	1178	450	155	248	540	1178	570	93

Balancing your Animals with your Forage

How much forage do our animals need each month?

We know each animal needs 4% of its weight in forage each day (daily utilization rate .04). If we multiply the daily utilization rate times 30 days, we get the monthly utilization rate which is 1.2. To figure out how much forage our herd needs each month we multiply the monthly utilization rate (1.2) times the number of animals (11) and the average weight (1200 lb).

$$\text{Amount of forage needed each month} = (1.2) \times (11 \text{ animals}) \times (\text{average weight } 1200\text{lb}) = 15,840 \text{ lb}$$

How much forage do we have each month?

To figure out how much forage we are producing each month, we take the monthly lb/acre produced by our pastures from Table 1, and multiply this amount by how many acres we have of each pasture. For example, looking at Table 1, we know that the bermudagrass/rye pasture produces 62lb/ac of forage in January. We multiply this by 10 acres to give us 620 lb. This is the total produced by that pasture in January, as shown in the Monthly Forage Balance Sheet below.

Beefy Acres: Monthly Forage Balance Sheet												
Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
10ac bermuda-grass/rye	620	1,120	10,800	11,400	16,740	14,100	20,150	17,980	9,300	5,890	5,700	1,200
10ac fescue	930	4,100	10,850	15,000	11,780	4,500	1,550	2,480	5,400	11,780	5,700	930
Total Amount Available	1,550	5,220	21,650	26,400	28,520	18,600	21,700	20,460	14,700	17,670	11,400	2,130
Total Amount Needed	15,840	15,840	15,840	15,840	15,840	15,840	15,840	15,840	15,840	15,840	15,840	15,840
surplus deficit	14,290	10,620	5,810	10,560	12,680	2,760	5,860	4,620	1,140	1,830	4,440	13,710

Putting it all together:

The monthly forage balance sheet gives you a good idea of what to expect during the year. You can use this information to plan your management activities. For example, you can stockpile part of a pasture or cut it for hay when you have a surplus and use it during the months you have a deficit, such as in the winter. You will also need to keep your animals off the pasture during the winter when the grass is not growing or growing very slowly. Overgrazing at this time can slow down spring growth or, if done for long periods, will severely damage your pasture. In our example above, we could probably graze until mid November. Looking at the height of the forage is the best way to decide when to start and stop grazing. Remember, the forage balance sheet is an estimate. The yields will vary each year, so you should be prepared for a drought or an early freeze. You can also revise the information each month as your animals gain weight during the season. Getting the proper balance of animals and forage is the foundation to good grazing management.

SMALL SCALE SOLUTIONS FOR YOUR FARM

Technical Help Is Available

Your local Natural Resources Conservation Service (NRCS) office has experienced conservationists that can assist you with balancing your animals with your forage. They can also help you develop a Conservation Plan to solve other problems you have identified on your farm.

There is no charge for our assistance. Simply call your local office at the number listed below to set up an appointment and we will come to your farm.

You may also be eligible to receive financial assistance, through a state or federal program. Your NRCS office will explain any programs that are available so you can make the best decision for your operation. All NRCS programs and services are voluntary.



Helping People Help the Land

For More Information Contact the:

Natural Resources Conservation Service

www.nrcs.usda.gov

Find your local NRCS office at <http://offices.sc.egov.usda.gov/locator/app>

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ESTIMATING

WATER REQUIREMENTS

FOR MATURE BEEF COWS

Cattle require a minimum amount of water, reflecting the water necessary for growth, fetal development, lactation, and replacing water lost from urine, sweat, and evaporation. An adequate supply of clean, fresh water is a critical component of maintaining healthy, productive livestock. Additionally, knowledge of water needs for livestock is necessary when designing water-supply systems where the water supply may be limited or the delivery system restricts access to water during periods of heavy use.

Water is necessary for the majority of life processes, including blood volume maintenance, regulation of temperature, growth, reproduction, lactation, and digestion. In fact, the body weight of mature cattle is about 50 percent water (Johnson et al. 2012). Primary factors

known to influence water requirements include age, weight, stage of production, and environment.

Compared to protein and energy requirements, water requirements and voluntary water intake of beef cattle have not been extensively studied in recent years. For example, water consumption guidelines published in *Nutrient Requirements of Beef Cattle* (NRC, 2000) were taken from research data published in 1956 (Winchester and Morris, 1956).

Considerably more voluntary water consumption and water requirement data are becoming available for growing and finishing cattle, whereas little information is available in published literature for mature beef cows. Current guidelines are restricted to 900- to 1,100-pound



An abundant, clean, fresh water supply is an essential element of a beef cattle production system.

mature weight in gestating cows and 900-pound lactating cows only (NRC, 2000). Recent data suggest mature weight in the modern beef cow ranges from 1,100 to 1,500 pounds (Kuehn et al., 2013). Consequently, this publication focuses on estimates of total water requirements for beef cows with varying mature weights at different stages of production and genetic potential for milk production.

AMBIENT TEMPERATURE

During warm months, daily ambient temperature and humidity have a dramatic effect on heat stress and thus water intake in feedlot cattle (Arias and Mader, 2011). These authors reported that a temperature humidity index was the best single environmental indicator of daily water intake. The temperature humidity index is calculated using a combination of the daily average temperature and relative humidity. The Cattle Comfort Index is a similar tool provided through the Oklahoma Mesonet and used to monitor heat and cold stress in cattle (Richards et al., 2012). The Cattle Comfort Index is calculated using ambient temperature, humidity, wind speed, precipitation, and sunlight.

The current National Research Council concludes that average daily ambient temperatures below 40 degrees Fahrenheit do not significantly influence water intake. Daily temperature above 40 degrees Fahrenheit, however, increase water consumption linearly (NRC, 2000). For example, water intake was reported to increase by 1.44 pounds per day in lactating dairy cows for each degree Fahrenheit increase in temperature (Murphy et al., 1983), 0.61 pound per day in growing dairy bulls for each one degree Fahrenheit (Meyer et al., 2006), and 0.5 pound per day in feedlot cattle for each one degree Fahrenheit (Hicks et al., 1988).

Published research investigating the influence of ambient temperature, humidity, or the combination on average daily water consumption for beef cows is not readily available. Consequently, for this publication, the influence of ambient temperature on water intake was estimated using the approximate mean of the published estimates shown above (0.85 pound of increased water intake per one degree increase in temperature beyond 40 degrees Fahrenheit). Therefore, for every 10 degrees Fahrenheit increase in ambient temperature, an additional one gallon of water should be supplied per animal.

MILK PRODUCTION

Milk composition in beef cows is about 4 percent fat and 8.3 percent other solids (protein, carbohydrates, and minerals; NRC, 2000). Consequently, average water

content of milk produced by beef cows is about 87.7 percent. Therefore, lactation has a direct impact on water requirements and water consumption. No publications defining the relationship of milk yield to water consumption in beef cows were found for this publication. Winchester and Morris (1956) concluded that lactating dairy cows consumed an additional 0.87 pound of water per pound of increased milk production. Similarly, Murphy et al. (1983) reported a linear relationship between milk yield and water intake in dairy cows with 0.9 pound of increased water intake for every 1 pound of additional milk produced. Therefore, water intake estimates shown in Table 2 were adjusted by 0.9 pound for each pound of milk produced.

FEED DRY MATTER CONTENT

The dry matter content of feedstuffs is the proportion of the feed that is not water. Since the water content of forage and feed is extremely variable (Table 1), and because all feedstuffs contain water, feed and forage are important sources of water for beef cattle. Because of this, not all water needs to be provided as free water (drinking water). Compared to dormant pasture, grains, and hay, feeds such as silages and growing pasture are higher in moisture. Nutritional guidelines for beef (NRC, 2000) and dairy (NRC, 2001) cows suggest that consumption of free water declines as the moisture content of feeds in the diet increases.

FORAGE AND FEED INTAKE

Water intake is highly related to rumen volume and feed dry matter intake (NRC, 2000 and 2001). Greater daily feed consumption is associated with greater rumen volume. Logically, greater mature weight is associated with greater rumen volume and dry matter feed intake (NRC, 2000). Therefore, for the purpose of these water requirement estimates, the influence of cow size and rumen volume on water intake is addressed through the influence of feed dry matter intake. For the estimates

Table 1. Dry Matter Content of Common Feedstuffs

Type of Feed	Dry Matter (%)
Sun cured hay; grass and legume	87–91
Grazed forage, vegetative	20–35
Grazed forage, boot stage	30–40
Grazed forage, seeded	75–85
Grazed forage, mature	80–90
Silage; grass, legume or grain	25–40
Haylage; grass and legume	40–60

presented in Table 2, we assumed that non-lactating beef cows consume an average of 2.2 percent of their body weight and lactating cows consume an average of 2.7 percent of their body weight in dry matter when provided average- or moderate-quality forage.

Diets high in protein increase water intake (NRC, 2001). Therefore, early spring forage or high-quality legume silage, for example, is expected to increase water consumption beyond the values shown in Table 2. Conversely, diets at the other end of the quality spectrum also may increase water consumption. While a low-quality diet reduces total dry matter intake, low-quality roughage contains a high proportion of indigestible fiber. Therefore, more moisture is required for additional mucous production to lubricate the digestive tract and move a greater volume of fibrous manure through the large intestine. Diets with a high concentration of salt and other minerals also increase water consumption (NRC, 2001).

ESTIMATES OF TOTAL DAILY WATER REQUIREMENTS FOR BEEF COWS

Table 2 provides estimates of water consumption based on mature cow body weight, average daily temperature, stage of production (gestation or lactation), as well as milk yield. Three levels of milk yield are provided. Zero

Table 2. Estimated Daily Water Requirements for Beef Cows

Cow Body Weight (lb)	Milk Production (lb/day)	Average Daily Temperature			
		°C	4	18	32
		°F	40	65	90
		*Gallons of Water/Day			
1,100	0	8.2	10.8	13.4	
1,100	10	10.5	13.1	15.7	
1,100	25	12.8	15.4	17.9	
1,300	0	9.2	11.8	14.3	
1,300	15	12.2	14.8	17.4	
1,300	30	14.5	17.1	19.7	
1,500	0	10.2	12.7	15.3	
1,500	20	14.0	16.5	19.1	
1,500	35	16.3	18.8	21.4	

*1 gallon is equivalent to 8.35 lbs.

KEY POINTS

- For each 10 degrees increase in ambient temperature above 40 degrees Fahrenheit, cattle consume about 1 more gallon of water per day.
- For each additional gallon of milk produced, cows need to drink an additional gallon of water.
- Feeds that are high in moisture contribute to water intake. The dryer the feeds consumed, the more drinking water required.

milk indicates cows that are dry or not lactating. The two levels of milk yield provided for each weight class of cows can be used to indicate differences in genetic potential for milk yield during peak lactation (around 45 to 60 days after calving). The two levels of milk yield also could be used to estimate the difference in milk yield (and thus water intake) from early lactation to the later stages of lactation because milk yield declines as the lactation period progresses beyond peak (NRC, 2000).

These estimates for water consumption are intended to represent total daily water consumption. Free water intake could be substantially lower than the estimates presented in this publication when beef cows consume feeds containing considerable moisture.

CONCLUSION

An abundant, clean, fresh water supply is an essential element of a beef cattle production system. Considerable work has been conducted to determine water consumption and factors influencing water consumption for dairy cows, growing cattle, and finishing cattle; however, relatively little research has been published to provide robust estimates for water consumption of beef cows. The estimates of total daily water requirements specific to beef cows in this publication were developed using equations developed by reviewing available published literature. Factors considered in these estimates include mature body weight, feed dry matter intake, milk yield, and average daily ambient temperature.

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MF3303 December 2016

ERM Record of
Communication

Day: Thursday

Date: 8/13/2020

ERM Employee :

David Sanguinetti

Conversation with:

Chris Mouton with Water Well Professionals

Number:

337-385-2558

Conversation:

Please provide a cost estimate for a 4 inch diameter 250-300' well in Plaquemines Parish including a water tank, electrical hook up, and 10 gpm submersible pump.

Mr. Mouton: "We are unable to make it to Plaquemines Parish but cost would be \$5,500 for a 4" diameter well to 150' and then \$14/ft after that which would come out to about \$7,000. That includes the pump, tank, and hook up. "

ERM Record of
Communication

Day: Monday

Date: 8/17/2020

ERM Employee : David Sanguinetti

Conversation with: Casey with Clear Water Pump & Well

Number: 985-966-5339

Conversation: Please provide cost to operate and maintain a 300' submersible pump used for cattle. Most likely run 30 minutes to an hour everyday."

Casey: "Operating in that capacity should last 20-30 years if installed property. No O&M costs unless pump breaks. Replacement would range from \$500-\$1000 including labor."

ERM Record of
Communication

Day: Tuesday and Wednesday

Date: 8/4/2020 and 8/5/2020

ERM Employee :

David Sanguinetti

Conversation with:

Troy Phillips

Position/ Organization:

Technician / Inframark (Belle
Chasse Water Systems

Number:

337-385-2558

Conversation:

Please provide a map showing service lines
alone LA-23 from Dockside Road to Russell

*Mr. Phillips with Inframark confirmed a water main
runs parallel to LA-23 on the western side of the
highway through the subject property.*

Can you provide a cost for a new service tap
to run under highway and under railroad?

*Mr. Phillips: That is answered in Tap
schedule. Inframark will handle.*

Does \$500 fee cover horizontal bore across
highway and railroad?

*Mr. Phillips: "No. \$500 fee will cover water line across
highway, Inframark would not be responsible for
crossing railroad tracks."*

M I S S I S S I P I

R I V E R

6" Line to Oronite Plant.

Sewer Plant Rd.

MISSOURI PACIFIC P.R.

AIRFIELD RESERVATION

500,000 G.A.L. ELEVATED WATER TOWER

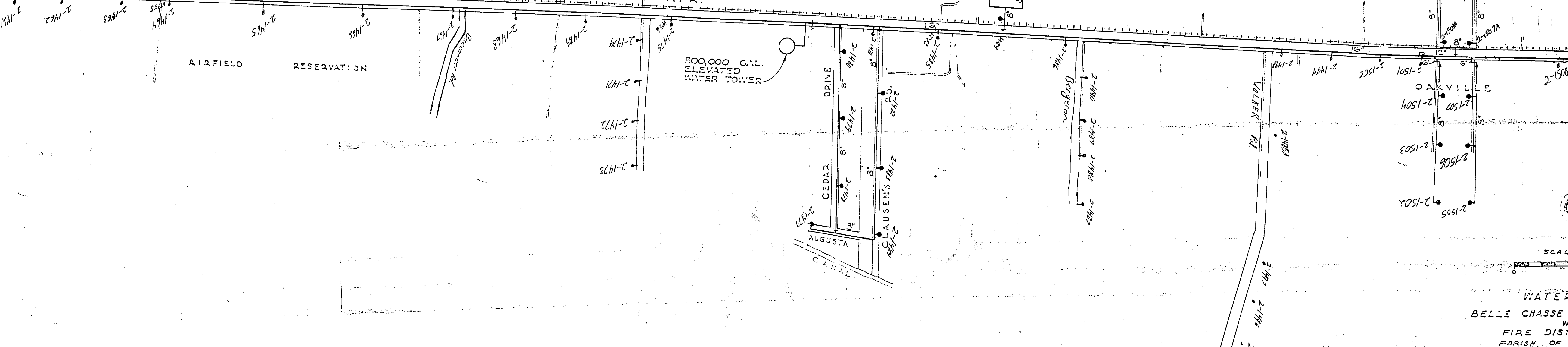
8" CEDAR GROVE 2-1720

DRIVE CEDAR AUGUSTA CANAL

Barger Rd

VALNER Rd

OAKVILLE
2-1501
2-1504
2-1507
2-1508
2-1502
2-1505



SCALE

WATER
BELLE CHASSE WA
WITH
FIRE DISTRI
PARISH OF PL

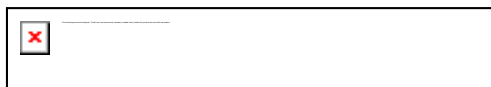
David Sanguinetti

From: Phillips, Troy <troy.phillips@inframark.com>
Sent: Tuesday, August 11, 2020 1:58 PM
To: David Sanguinetti
Subject: Re: Water Main along Hwy 23 South of Sewer Plant Rd.

David,

That 16" Water Main continues North to Russell Drive. I don't have a print that shows it.

Troy Phillips | Field Services Manager



126 Sewer Plant Road | Belle Chasse, LA 70037

(O) 504.392.4177 | (M) 504.912.2673 | www.inframark.com

From: David Sanguinetti <David.Sanguinetti@erm.com>
Sent: Tuesday, August 11, 2020 1:51 PM
To: Phillips, Troy <troy.phillips@inframark.com>
Subject: RE: Water Main along Hwy 23 South of Sewer Plant Rd.

Troy,

Thanks for sending that figure. I wanted to check if there was another one showing the property north up to Russell Drive. Please let me know if that is possible.

Again, thank you so much for your help.

Regards,
David Sanguinetti
Associate Scientist

ERM
CityCentre Four | 840 West Sam Houston Parkway North, Suite 600 | Houston, Texas 77024
T +1 281 600 1000 | M 713 397 8997



From: Phillips, Troy <troy.phillips@inframark.com>
Sent: Tuesday, August 11, 2020 1:41 PM
To: David Sanguinetti <David.Sanguinetti@erm.com>
Subject: Water Main along Hwy 23 South of Sewer Plant Rd.

David,

This is an old print that shows the 16" WM along Hwy 23, there is a 20" WM that is a transmission line only that was installed next to the 16".

Troy Phillips | Field Services Manager



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ERM Record of
Communication

Day: Tuesday

Date: 8/4/2020

ERM Employee :

David Sanguinetti

Conversation with:

Enjoli Tyler

Position/ Organization:

Plaquemines Parish Water Works

Number:

504-934-250

Conversation:

Please provide a map showing service lines
alone LA-23 from Dockside Road to Russell

Ms. Tyler: Inframark would handle.

Can you provide a cost for a new service tap
to run under highway and under railroad?

Ms. Tyler: Answered in Tap schedule.

Inframark will handle. Confirm with them.

Provide monthly cost for water and how many gallons
does monthly charge include and charge for water use
above monthly allotment?

If we know we are going to use 13,000
gallons a month, will that ~\$32 a month rate
cover that much water?

Ms. Tyler: \$27.14 for 0-4,000 gallons then
\$4.73/1,000 gallons up to 16,000 gallons
then move to next tier.

Would there be charge for sewer use since
the water just be used for cattle?

Ms. Tyler: Sewer not required.

TAPPING FEES AS PER ORD SEC 22-9

METER SIZE	SAME SIDE AS MAIN WATER LINE	OPPOSITE SIDE OF THE STREET	4-LANE HWY WITHOUT RAILROAD SAME SIDE	4-LANE HWY WITHOUT RAILROAD OPPOSITE SIDE	4-LANE HWY WITH RAILROAD SAME SIDE	4-LANE HWY WITH RAILROAD OPPOSITE SIDE
3/4"	\$200	\$250	\$200	\$300	\$200	\$500
1"	\$650	\$975	\$650	\$1,800	\$650	\$2,525
1 1/2"	\$1,220	\$1,630	\$1,220	\$2,125	\$1,220	\$2,690
2"	\$1,545	\$2,075	\$1,545	\$2,690	\$1,545	\$3,100

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Manufacturer: Ace Roto-Mold / Den-Hartog
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Color: Green


1-1/2" Drain w/ Plug

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