

Drainage FACTSHEET

ECONOMICS OF SUBSURFACE DRAINAGE

Estimating Cost

The first step in designing a drainage system is to verify the economic feasibility of the drainage works. To do an initial cost estimate of a drainage system, first you need to know the size of the field. Secondly you need to know the drain spacing required. The drain spacing is based on the soils found on the site and cropping practices. The estimated drainage spacing in Table 1 is based on average cropping management systems. The soil profile is given in general terms with the soil texture and the depth of each layer. Table 2 gives some adjustment factors for specific cropping practices and land use demand. [The BC Agricultural Drainage Manual](#) contains more detailed information on determining field conditions.

CAUTION: It is essential to corroborate the simplified drain recommendations with on-site surveys and measurements for final design purposes. The drain spacings shown in the tables in this factsheet are only for preliminary economic analysis.

The total length of pipe required for a field can be estimated by using Table 3. The example below provides guidance on how to use the tables. The actual cost of the drainage system can be calculated using average prices found in Table 4. On average when fields are larger than 8 hectare in size an additional cost for a collector or ditching should be added to the initial cost estimate. This added cost increases the initial cost by approximately 5%.

Table 1 also indicates some special requirements such as filters and subsoiling that may have to be factored into the total cost of the system. The site suitability for subirrigation may also be considered. If the site is suitable then the added benefit of operational cost savings can also be taken into account. The savings are mainly realized in reduced energy consumption compared to conventional irrigation systems. There may also be savings in reduced fertilizer costs. Subirrigation is not dependent only on soil type. Field slope, water table depth and water quality should also be considered when designing for subirrigation. For more information refer to the [Controlled Drainage / Subirrigation Factsheet](#)

Example 1: Preliminary Cost Estimation

A landowner has a 16 hectare field, his soil profile has 50 cm of coarse textured material over fine dense subsoil. Table 1 indicates a 16 m spacing and a 0.8 m depth for the drains. Table 2 indicates the crop to be grown has a high drainage demand. An adjustment factor of 0.9 is used giving a drain spacing of 14 meters. The total length of pipe required can be estimated from Table 3, in this case it is 11,400 meters. Based on the average cost of \$2.50 per meter (1997 prices) of installed drainage pipe the rough cost estimate for this system is \$28,500 or \$1781 per hectare.

Cost Benefit Analysis

This is a partial budget calculation giving the benefits and costs directly associated with the use of drainage. The cost of a complete and properly designed drainage system has been estimated for a forage crop. In the budget analysis only the costs that are directly associated to the present lack of a drainage system have been included. Note this example is for explanatory purposes only.

Example 2: Economic Benefit for Forage Production

For a grass forage crop grown in South Coastal British Columbia. The drainage system includes a grid of parallel drain lines installed every 18 meters and draining directly in to a ditch. The system is installed by a drainage contractor and is depreciated over 30 years. Regular maintenance is expected and an annual operating cost is estimated to ensure that the drainage system functions properly. Costs of ditching or pumping have not been included, however these may need consideration for some sites.

Assumptions:

Added crop production	extra yield 3.4 tonnes/hectare
Market value of local hay	\$200 / tonne
Cost of drainage	\$1350 / ha
Interest rate	8%
Reseeding changed from every 4 th year to every 6 th year	

BENEFITS	COST
<u>Added Annual Returns</u> 3.4 tonne hay / ha x \$220 / tonne = \$748 / ha	<u>Added Annual Costs</u> Harvesting <ul style="list-style-type: none"> • variable costs \$100/ ha (e.g. fuel, labour, materials) • fixed costs \$10 / ha (e.g. depreciation)
<u>Reduced Annual Costs</u> reseeding \$ 22 / ha	<u>Drains</u> <ul style="list-style-type: none"> • depreciation \$ 45 / ha (1350 / 30 years) • interest (average) \$ 55 / ha (1350 / 2) x 8%
<u>Reduced Annual Costs</u> \$ 0 / ha	<u>Reduced Annual Costs</u> \$ 0 / ha
TOTAL BENEFITS \$ 770 / ha	TOTAL COSTS \$ 220 / ha
The net benefit of the drainage system works out to be (\$770 - \$220) \$550 per hectare	

In this example the extra yield is anticipated to come from an increase in the total number of cuts of forage per year. In particular the timing of the first cut. Increase in total yield as well as improved quality are also expected. Economic benefit from improved quality was not calculated.

Improved drainage is expected to reduce the frequency of seeding. This is expected as soil compaction and rutting will be reduced and overall stand health will be improved. Some additional costs in terms of machinery

Table 1 Approximate Drain Spacing Recommendations Based on Generalized Soil Profiles					
Depth (cm)	Texture	Maximum Drain Spacing (m)	Minimum Drain Depth (m)	Special Requirements	Subirrigation Suitability
0-150	Medium-Coarse	20	1.2	Filter	H
0-150	Medium	16	1.2	-	M
0-150	Fine	14	1.2	-	L
0-100 100-150	Coarse Fine-Dense	18	1.2	Filter	H
0-100 100-150	Medium Fine-Dense	14	1.2	-	M
0-100 100-150	Fine Fine-Dense	12	1	Subsoiling	L
0-50 50-150	Coarse Fine-Dense	16	0.8	Subsoiling	H
0-50 50-150	Medium Fine-Dense	12	0.8	Subsoiling	M
0-50 50-150	Fine Fine-Dense	10	0.8	Subsoiling	L
0-50 50-150	Medium Coarse	18	1.2	Filter	H
0-100 100-150	Medium-Fine Coarse	16	1.2	Filter & Subsoiling	M
0-40 40-150	Organic Fine-Dense	12	1	Subsoiling	L
0-40 40-150	Organic Medium-Coarse	16	1.2	Filter	H
0-150	Organic	14	1.3	-	M
0-100 100-150	Organic Medium	14	1.2	-	L
0-50 50-100 100-150	Organic Coarse Fine-Dense	18	1	Filter	H
0-50 50-100 100-150	Medium-Coarse Fine-Dense Medium-Coarse	12	0.8	Filter & Subsoiling	L

Table 2 Land Use and Subirrigation Adjustment Factors		
Land Use Demand Level	Description	Adjustment Factor
Highest Demand	Access to land is desirable all year round. Crops to be grown are very sensitive to excess water and are of the highest value. Use only in the most stringent cases.	0.8
High Demand	Perennial ornamentals, early or year-round pasture, alfalfa, other high value or water sensitive crops and soft fruits with the exception of blueberries and cranberries.	0.9
Normal Demand	Mid-season vegetable crops, hay and pasture land, over wintering cereals used as cover crops, cole crops and blueberries.	1
Subirrigation	All crops.	0.65
Controlled Drainage	All crops and depending on soil conditions a range of factors.	1.0 to 1.1

Table 3 Length of Drain Pipe Required per Hectare for Various Spacings, meters						
Field Size (hectares)	Drain Spacing (meters)					
	8	10	12	14	18	20
2	2500	2000	1600	1400	1100	1000
4	5000	4000	3300	2800	2200	2000
8	10 000	8000	6700	5700	4400	4000
16	20 000	16 000	13 300	11 400	8800	8000
30	37 500	30 000	25 000	21 400	16 600	15 000
60	75 000	60 000	50 000	43 000	33 300	30 000

Table 4 Itemized Costs		
Description	Materials*	Contractor Installed**
Survey and Design		\$25.00/ha
Drainage Laterals and Mains		
2" plastic drain	\$1.07/m	
100mm (4") plastic drain	\$1.49/m	\$2.38/m
4" plastic drain, c/w filter	\$2.14/m	\$2.59/m
150mm (6") plastic drain	\$3.71/m	\$4.36/m
6" plastic drain, c/w filter	\$4.44/m	\$5.66/m
200mm (8") plastic drain, non-perforated	\$7.47/m	\$8.36/m

Table 4 Itemized Costs continued			
Drainage Fittings and Accessories			
100mm (4") couplers			\$0.81 ea.
4" endcaps			\$0.81 ea.
4" outlets			\$25.00 ea.
4" rodent traps			\$4.00 ea.
4" x 4" tees			\$2.21 ea.
150mm (6") couplers			\$3.20 ea.
6" endcaps			\$2.80 ea.
6" rodent traps			\$6.00 ea.
6" x 4" tees			\$10.15 ea.
200mm (8") couplers			\$8.15 ea.
8" tees			\$13.65 ea.
Corrugated Steel Pipe Culverts			
250mm(9.8")	1.6mm thick wall		\$27.16/m
300mm(11.8")	1.6mm thick wall		\$31.84/m
400mm(15.7")	1.6mm thick wall		\$42.16/m
500mm(19.7")	1.6mm thick wall		\$53.16/m
600mm(23.6")	1.6mm thick wall		\$63.66/m
700mm(27.5")	1.6mm thick wall		\$74.38/m
800mm(31.5")	1.6mm thick wall		\$84.96/m
900mm(35.4")	1.6mm thick wall		\$95.56/m
Polyethylene Culvert Pipe			
250mm Big "O" Boss			\$20.30/m
300mm Big "O" Boss			\$23.60/m
400mm Big "O" Boss			\$35.60/m
450mm Big "O" Boss			\$39.90/m
500mm Big "O" Boss			\$48.00/m
600mm Big "O" Boss			\$67.65/m
750mm Big "O" Boss			\$101.20/m
900mm Big "O" Boss			\$129.10/m
Ditch Construction		Ditch Cleaning	
Sidecast only	\$3.50/cubic metre	Less than 1.5 cubic metre/metre	\$10.00/m ³
Sidecast and Spread	\$5.00/cubic metre	1.5 m ³ /m to 3.0 cubic metre/metre	\$15.00/m ³
Rocking	\$15.00/cubic metre	Greater than 3.0 cubic metre/metre	\$20.00/m ³

* Materials cost for drain tubing refer to an agricultural purchase for a minimum of 500m.

** Installation by contractor with Chain Trencher or Trenchless Plow

For further information on related topics, please visit our website

Resource Management Branch

www.agf.gov.bc.ca/resmgmt

Linking to our

[Publications and Conceptual Plans](#)

FOR FURTHER INFORMATION CONTACT

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