Texas Land Application Permits – Agronomy Reviews

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Presentation Outline

- TLAP applications
- Agronomy technical considerations
- Water balance calculation
- Agronomy permit recommendations

Texas Land Application Permits (TLAPs)

- Types of TLAPs
  - Evaporation – 30 TAC 309
  - Surface irrigation – 30 TAC 309
  - Subsurface irrigation – 30 TAC 309
  - Subsurface Area Drip Dispersal System (SADDS) – 30 TAC 222

TLAP Permit Application Forms

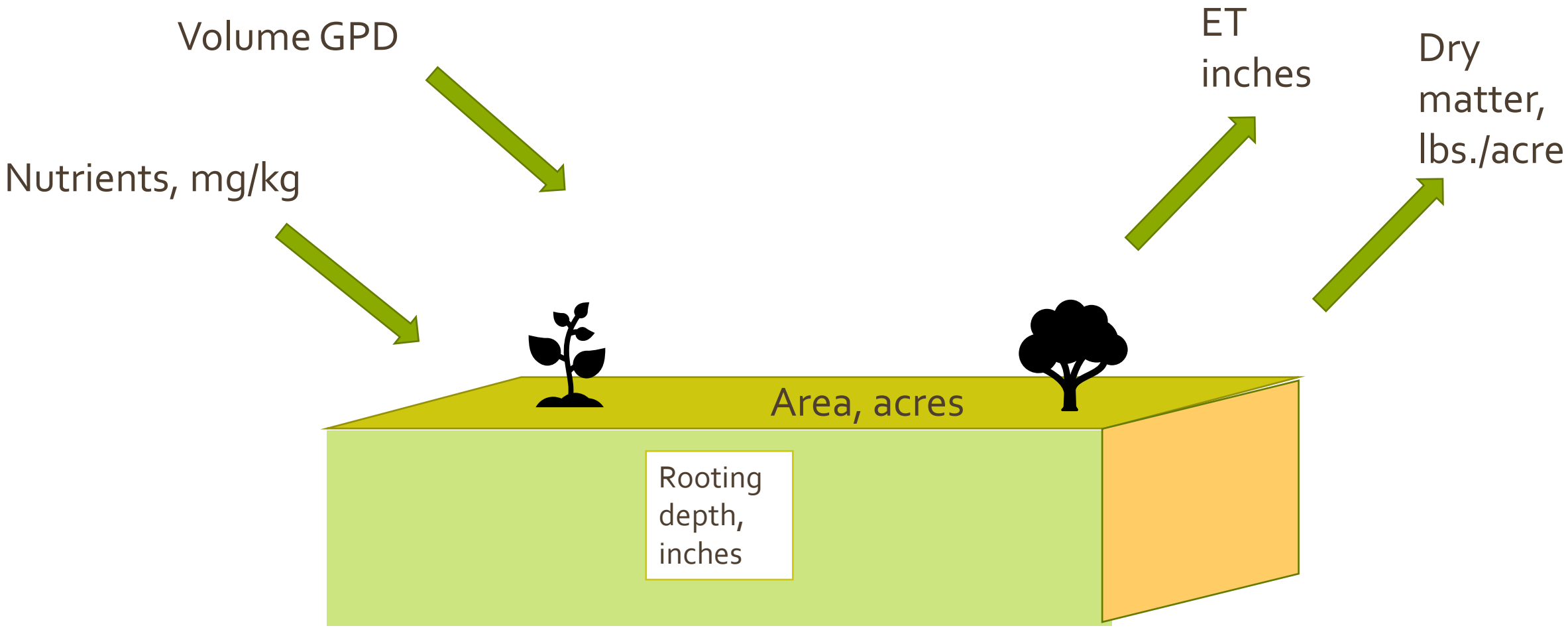
- Domestic Wastewater Permit Application, Technical Reports – Form TCEQ-10054
  - Domestic Worksheet 3.0 – Land Application of Effluent
  - Domestic Worksheet 3.1 – Surface Land Disposal of Effluent
  - Domestic Worksheet 3.2 – Subsurface Land Disposal of Effluent
  - Domestic Worksheet 3.3 – Subsurface Area Drip Dispersal Systems (SADDS)

Water Quality Assessment Team TLAP Reviews

- Two types of technical reviews
  - Geology
  - Agronomy

Agronomy Reviews

TLAP System


Volume GPD
Nutrients, mg/kg
ET
inches
Dry
matter,
lbs./acre
Area, acres
Rooting
depth,
inches

Agronomy Overview

- No discharge into ground or surface waters.
- Effluent to remain in the root zone and/or be utilized by the plants.
- Soil properties allow for temporary hold of effluent and prevent ponding.
- Proposed crops must uptake all nutrients applied to prevent accumulation in soil.
- Recommendations to permit writer are based on site-specific conditions, such as climactic conditions and the use of native plants.

Application Completeness

- Daily application rate
- Size, slope, and location
- Cropping plan
- Natural Resource Conservation Service (NRCS) web soil survey soil map of actual area
- Quality of irrigation effluent
- Soil analyses results
- Site preparation plan
- Land use – green space, golf course, park, etc.

Cropping Plan

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Last Revised - 8/31/09																
1=1	2=2	3=3	4=5	5=6	6=7	7=8	8=9	9=10	10=11	11=19	12=20	13=21	14=22	15=23	16=24	
Crop	Crop N requirement	Crop P2O5 requirement	or air dried produced per year	% N (in column D value)	% P (in column D value)	% K (in column D value)		Crop N Removal Rate	Crop P_2O_5 Removal Rate	NO_3-N ppm	Max N lbs	P rate	P Factor	K rate	K Factor	
Coastal 2 Cut + Graze M	260	125	10000	1.98%	0.27%	1.40%		198	62	130	260	125	2.5	243	1.08	
Coastal 2 Cut + Graze VH	260	125	10000	1.98%	0.27%	1.40%		198	62	130	260	125	2.5	243	1.08	
Coastal 2 Cut + Graze VL - L	260	125	10000	1.98%	0.27%	1.40%		198	62	130	260	125	2.5	243	1.08	
Coastal 2 Cut Hay H	200	125	9000	1.88%	0.19%	1.40%		169	39	100	200	125	2.5	225		
Coastal 2 Cut Hay M	200	125	9000	1.88%	0.19%	1.40%		169	39	100	200	125	2.5	225		
Coastal 2 Cut Hay VH	200	125	9000	1.88%	0.19%	1.40%		169	39	100	200	125	2.5	225		
Coastal 2 Cut Hay VL - L	200	125	9000	1.88%	0.19%	1.40%		169	39	100	200	125	2.5	225		
Coastal 3 Cut + Graze H	360	125	13000	1.98%	0.27%	1.40%		257	80	180	360	125	2.5	243	1.08	
Coastal 3 Cut + Graze M	360	125	13000	1.98%	0.27%	1.40%		257	80	180	360	125	2.5	243	1.08	
Coastal 3 Cut + Graze VH	360	125	13000	1.98%	0.27%	1.40%		257	80	180	360	125	2.5	243	1.08	
Coastal 3 Cut + Graze VL - L	360	125	13000	1.98%	0.27%	1.40%		257	80	180	360	125	2.5	243	1.08	
Coastal 3 Cut Hay H	300	125	12000	1.98%	0.27%	1.40%		238	74	150	300	125	2.5	243	1.08	
Coastal 3 Cut Hay M	300	125	12000	1.98%	0.27%	1.40%		238	74	150	300	125	2.5	243	1.08	
Coastal 3 Cut Hay VH	300	125	12000	1.98%	0.27%	1.40%		238	74	150	300	125	2.5	243	1.08	
Coastal 3 Cut Hay VL - L	300	125	12000	1.98%	0.27%	1.40%		238	74	150	300	125	2.5	243	1.08	
Coastal 4 Cut Hay H	400	170	13000	1.98%	0.27%	1.40%		257	80	200	400	169	3.38	323	1.42	
Coastal 4 Cut Hay M	400	170	13000	1.98%	0.27%	1.40%		257	80	200	400	169	3.38	323	1.42	
Coastal 4 Cut Hay VH	400	170	13000	1.98%	0.27%	1.40%		257	80	200	400	169	3.38	323	1.42	
Coastal 4 Cut Hay VL - L	400	170	13000	1.98%	0.27%	1.40%		257	80	200	400	169	3.38	323	1.42	
Coastal 5-6 Cut Hay H	500	170	15000	1.98%	0.27%	1.40%		297	93	250	500	169	3.38	323	1.42	
Coastal 5-6 Cut Hay M	500	170	15000	1.98%	0.27%	1.40%		297	93	250	500	169	3.38	323	1.42	
Coastal 5-6 Cut Hay VH	500	170	15000	1.98%	0.27%	1.40%		297	93	250	500	169	3.38	323	1.42	
Coastal 5-6 Cut Hay VL - L	500	170	15000	1.98%	0.27%	1.40%		297	93	250	500	169	3.38	323	1.42	
Coastal graze 1 AU/1 ac, RG mod graze H	380	125	15700	1.90%	0.25%	1.41%		298	90	190	380	125	1.25	240	0.95	
Coastal graze 1 AU/1 ac, RG mod graze M	380	125	15700	1.90%	0.25%	1.41%		298	90	190	380	125	1.25	240	0.95	
Coastal graze 1 AU/1 ac, RG mod graze VH	380	125	15700	1.90%	0.25%	1.41%		298	90	190	380	125	1.25	240	0.95	
Coastal graze 1 AU/1 ac, RG mod graze VL - L	380	125	15700	1.90%	0.25%	1.41%		298	90	190	380	125	1.25	240	0.95	
Coastal graze 1 AU/1 ac, SG mod graze H	400	175	15800	1.90%	0.25%	1.41%		300	90	200	400	175	1.75	240	0.95	
Coastal graze 1 AU/1 ac, SG mod graze M	400	175	15800	1.90%	0.25%	1.41%		300	90	200	400	175	1.75	240	0.95	
Coastal graze 1 AU/1 ac, SG mod graze VH	400	175	15800	1.90%	0.25%	1.41%		300	90	200	400	175	1.75	240	0.95	
Coastal graze 1 AU/1 ac, SG mod graze VL - L	400	175	15800	1.90%	0.25%	1.41%		300	90	200	400	175	1.75	240	0.95	
Coastal Grazing + 1 Hay H	160	70	7700	1.88%	0.19%	1.40%		145	34	80	160	69	1.38	150	1	
Coastal Grazing + 1 Hay M	160	70	7700	1.88%	0.19%	1.40%		145	34	80	160	69	1.38	150	1	
Coastal Grazing + 1 Hay VH	160	70	7700	1.88%	0.19%	1.40%		145	34	80	160	69	1.38	150	1	
Coastal Grazing + 1 Hay VL - L	160	70	7700	1.88%	0.19%	1.40%		145	34	80	160	69	1.38	150	1	
Coastal Grazing 1 AU/0.5 ac H	300	70	11000	1.98%	0.27%	1.40%		218	68	150	300	69	1.38	120	0.95	
Coastal Grazing 1 AU/0.5 ac M	300	70	11000	1.98%	0.27%	1.40%		218	68	150	300	69	1.38	120	0.95	
Coastal Grazing 1 AU/0.5 ac VH	300	70	11000	1.98%	0.27%	1.40%		218	68	150	300	69	1.38	120	0.95	
Coastal Grazing 1 AU/0.5 ac VL - L	300	70	11000	1.98%	0.27%	1.40%		218	68	150	300	69	1.38	120	0.95	
Coastal Grazing 1 AU/1 ac H	240	70	10000	1.98%	0.27%	1.40%		198	62	120	240	69	1.38	120	0.95	
Coastal Grazing 1 AU/1 ac M	240	70	10000	1.98%	0.27%	1.40%		198	62	120	240	69	1.38	120	0.95	
Coastal Grazing 1 AU/1 ac VH	240	70	10000	1.98%	0.27%	1.40%		198	62	120	240	69	1.38	120	0.95	
Coastal Grazing 1 AU/1 ac VL - L	240	70	10000	1.98%	0.27%	1.40%		198	62	120	240	69	1.38	120	0.95	

Texas A&M AgriLife https://nutrientmanagement.tamu.edu/planning/

- Soil map with crops
- Cool and warm season plant species
- Crop yield goals
- Crop growing season
- Crop nutrient requirements – S Crops Table
- Additional fertilizer requirements
- Minimum/maximum harvest height (for grass crops)
- Supplemental watering requirements
- Crop salt tolerances
- Harvesting method/number of harvests
- Justification for not removing existing vegetation to be irrigated

NRCS Soil Map

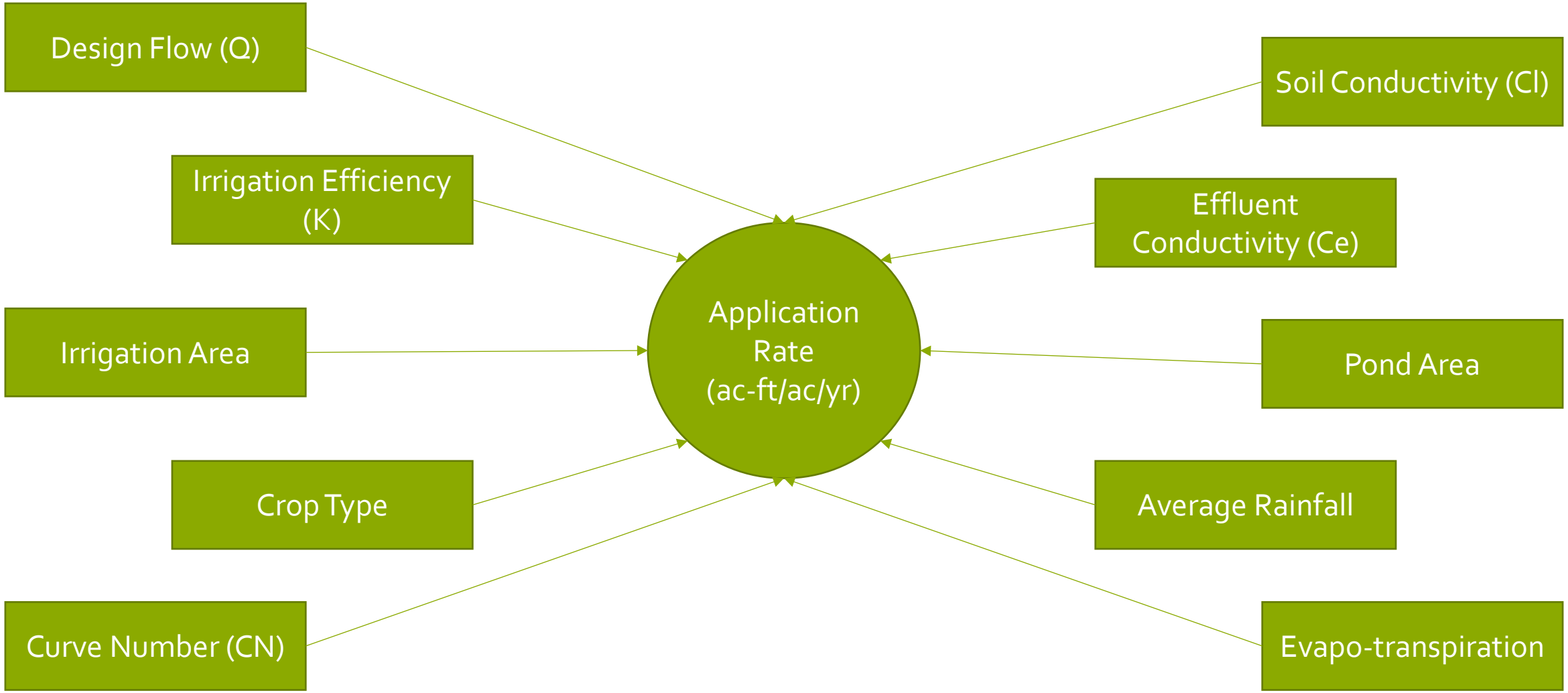
USDA NRCS https://websoilsurvey.sc.egov.usda.gov/app/

- Map out actual application area instead of entire property.
- Soil properties
  - Infiltration
  - Soil texture
- Available water capacity
- Water table location
- Runoff potential
- Identify whether any of the properties could have an adverse effect on potential application rate.

Soil Analyses

- Is there nutrient accumulation?
- Analyses of soil depths of 0-6 in., 6-18 in., 18-30 in.
  - pH
  - Electrical conductivity
  - Nitrate-nitrogen
  - Total Kjeldahl nitrogen
  - Plant-available phosphorus
  - Plant-available potassium

Water Balance for Surface Spray Systems



Input Values

- Curve Number (CN) - TR-55, Urban Hydrology for Small Watersheds, USDA/NRCS
- Soil Conductivity (Cl) - Provided in application through "Maximum Allowable Conductivity of Soil Solution" table in 30 TAC 309.20
- Effluent Conductivity (Ce)- Provided in application through effluent analyses
- Pond and irrigation areas – Provided in application
- Effluent Efficiency (K) - 0.85, unless the irrigation manufacturer supports a different value
- Design Flow (Q) - Provided in application
- Average rainfall – Texas Water Development Board (TWDB), Water Data for Texas website
- Evapotranspiration – Texas Board of Water Engineers Bulletin 6019 (July 1962)

Spreadsheet/model

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9a)	(9b)	(10)	(11)
Month	Avg Rain	Avg Runoff	Avg Infilt Rainfall	Evapo-trans.	Required Leach	Total Water Needs	Effluent Needed in Root Zone	Raw Net Evap. from Reservoir	Reservoir Net Evap. (as inches on plot acres)	Effluent Needed Based on Irrigation Efficiency	Reservoir Consumption (as inches on plot acres)
Units →	*inches*	*inches*	*inches*	*inches*	*inches*	*inches*	*inches*	*inches*	*inches*	*inches*	*inches*
January	1.53	0.25	1.28	0.99	0.00	0.99	0.00	1.06	0.12	0.00	0.12
February	2.08	0.53	1.55	1.35	0.00	1.35	0.00	0.67	0.07	0.00	0.07
March	2.68	0.91	1.77	3.33	0.34	3.67	1.89	1.48	0.16	2.23	2.39
April	2.72	0.93	1.79	4.05	0.49	4.54	2.75	2.48	0.28	3.24	3.52
May	4.11	1.98	2.14	7.20	1.09	8.29	6.16	1.23	0.14	7.25	7.38
June	3.59	1.57	2.02	8.10	1.31	9.41	7.39	3.32	0.37	8.69	9.06
July	2.13	0.56	1.57	8.37	1.47	9.84	8.27	5.86	0.65	9.73	10.38
August	2.56	0.83	1.73	5.31	0.77	6.08	4.35	5.06	0.56	5.12	5.68
September	2.85	1.03	1.83	6.03	0.91	6.94	5.11	2.99	0.33	6.01	6.34
October	3.10	1.20	1.90	4.68	0.60	5.28	3.38	1.81	0.20	3.98	4.18
November	2.13	0.56	1.57	1.89	0.07	1.96	0.39	1.18	0.13	0.45	0.58
December	1.51	0.24	1.27	0.81	0.00	0.81	0.00	0.92	0.10	0.00	0.10
Totals	31.00	10.57	20.43	52.11	7.05	59.16	39.69	28.06	3.12	46.69	49.81

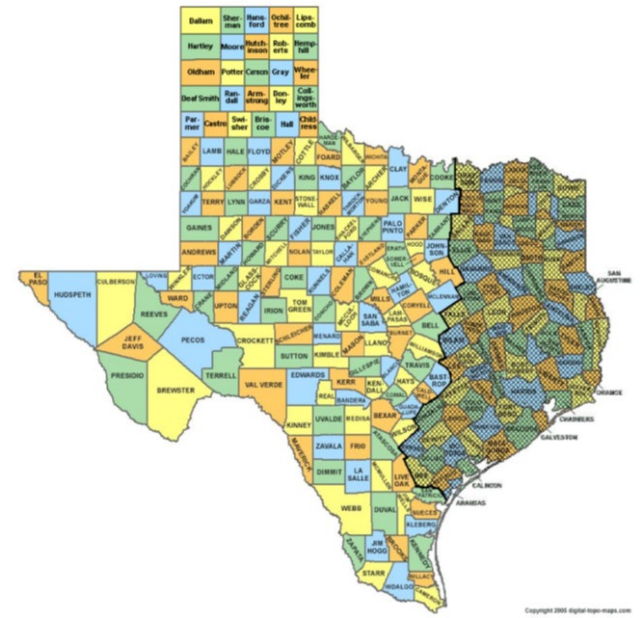
Permitted application rate

Output

- Application rate in ac-ft/ac/year
- Final application rate is the most stringent of the following:
  - Calculated volume/acreage/time
  - Nutrient limited rate
  - Water balance
  - Applicant requested rate

SADDs

Figure 1: 30 TAC §222.83(a)(2)



- 30 TAC §222.839(a)(1)
  - Application rate of 0.1 gal/ft²/day unless otherwise proven by applicant.
- 30 TAC §222.839(a)(1)

Figure 2: 30 TAC 222.83(a)(2)

AR = ET - RAINe + LEACH

Where:

AR = hydraulic application rate (inches per month)

ET = ETo x Kc , the actual water requirement of crop (inches per month)

ETo = potential evapotranspiration (inches per month)

Kc = crop coefficient (decimal) Kc ranges from 0.5 to 1.0

RAINe = RAIN x EF%, the effective rainfall (inches per month)

RAIN = total rainfall (inches per month)

EF% = effective rainfall percentage is the portion of rainfall/precipitation (inches) that infiltrates into the soil. An EF% of any value other than 0.67 must by justified by the applicant and approved by the executive director.

LEACH = leaching volume (inches per month). The leaching fraction may be determined using the electrical conductivity (millimhos/cm at 25° C) of the applied water and targeted soil salinity level (see §309.20(b)(3)(A) of this title (relating to Land Disposal of Sewage Effluent); or

Figure 3: 30 TAC §222.83(a)(2)

SMa = ET - RAINe + LEACH - AR

Where:

SMa - change in available soil moisture and is calculated from the soil depth and soil water holding capacity. Soil water holding capacity is defined as the volume of water (inches) held in the soil between field capacity and permanent wilting point.

Important Special Provisions

- Effluent is not to be applied during rainfall events or when the ground is frozen or saturated.
- Land application fields are to be monitored to ensure vegetation and soils are in good condition.
- Irrigation practices are to be managed to prevent pooling of effluent.
- Crop shall be harvested at least once a year (cut and clippings removed from the field).
- SADDS-specific – must maintain a minimum root-able soil depth of 12 inches below the drip irrigation lines

Site-Specific Special Provisions

- Can include
  - Removing large rocks
  - Adding topsoil to insure adequate rooting zone
  - Best management practices
  - Specific application and rest period frequencies
  - Effluent nutrient analyses and loading calculations

Any questions?

Ask now or feel free to call the WQAT Agronomists:
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