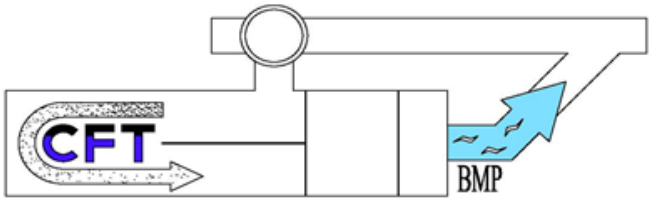
COUNTER FLOW TECHNOLOGY WATER QUALITY UNITS
CFT TECHNICAL INTRODUCTION

Ever changing storm water regulations continue to emphasize the importance of Best Management Practices to address waterquality issues . . . Lane's Counter Flow Technology provides a solution to those needs . . .



INTRODUCTION

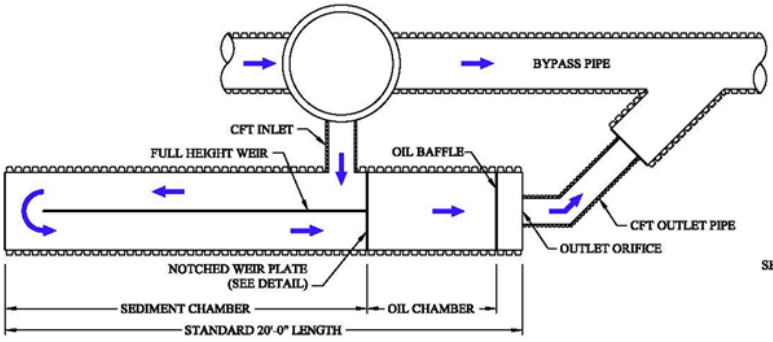
Lane's Counter Flow Technology provides a mechanism to intercept storm water flow, remove pollutants, and discharge treated flow in a manner suitable for today's storm water regulators. Ever changing storm water regulations continue to emphasize the importance of Best Management Practices to address water quality issues and associated mandates set forth by the EPA. Simply put, Counter Flow Technology provides a solution to those needs by completely treating the "first flush."

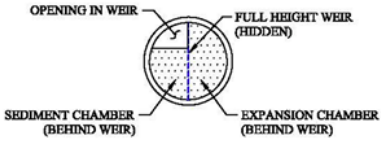
GENERAL

LANE has incorporated weir and dividing plates into their larger diameter corrugated HDPE pipes to create chambers conducive to directing and reducing flow velocity. Unlike many of today's emerging water quality units, Lane's Counter Flow Technology attains the efficiency of larger and more costly units by re-directing and lengthening the flow travel path to achieve slower velocities and increased settling times. The final chamber allows for the removal of hydrocarbons and floatable debris before routing flow back into the storm drainage system at a restricted rate.

LANE'S CFT IS DESIGNED TO REMOVE SEDIMENT AND HYDROCARBONS USING AN INCREASED FLOW PATH LENGTH AND CONTROLLED VELOCITIES.

The Lane CFT consists of a 20-ft or 40-ft mainline segment of 36", 42", 48" or 60" corrugated HDPE, along with inlet, outlet and bypass lines. Flow entering the mainline segment of the CFT is immediately re-directed via a full height plate that bisects the unit longitudinally. Flow is again re-directed at the extremity of the unit before being routed through the sediment chamber and under an oil baffle prior to discharging through an orifice outlet.





VARYING THE SIZE OF THE ORIFICE OUTLET ALLOWS DESIGNERS TO ATTAIN DIFFERENT FLOW RATES THROUGH THE MAINLINE SEGMENT.

The option of using different CFT lengths and diameters in conjunction with varying orifice outlet sizes allows designers to meet a variety of treated flow requirements determined by local agencies.

POLLUTANT REMOVAL REGULATIONS

The water quality regulations are typically associated with what is commonly referred to as the *"first flush."* The first flush occurs at the beginning of each rain event as sediment deposited from the previous event, as well as any oil or floatable debris that have since accumulated, is collected and carried away with the initial rain water flow.

THE LANE CFT IS DESIGNED TO CAPTURE AND TREAT THE *"FIRST FLUSH"* . . . THE BYPASS LINE IS SIZED TO PASS THE DESIGN STORM.

THE ABILITY TO BYPASS LARGE STORMS PREVENTS RE-SUSPENSION OF CAPTURED POLLUTANTS.

After pollutants from the first flush have been captured and stored it is conceivable that longer duration storm events would generate flows that exceed the hydraulic capacity of the CFT, making the inclusion of a bypass line a necessity. The bypass system prevents re-suspension by diverting flows greater than the first flush, and is typically sized to accommodate the design storm.

The Lane CFT is designed to meet the permit requirements of the NPDES Phase II program set by the EPA. The design of the CFT allows for the settling and collecting of sediment, as well as the accumulation of floatable debris, oil and related byproducts.

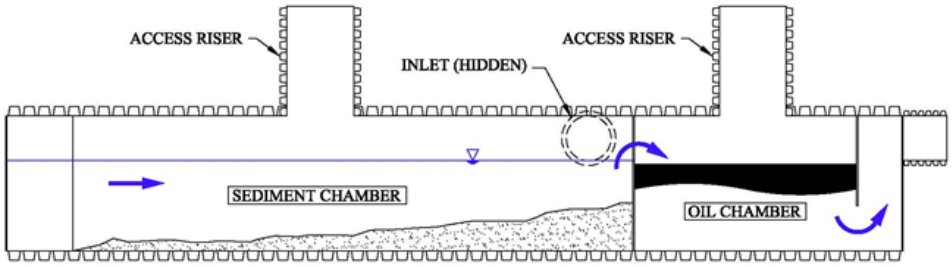
THE LANE CFT IS DESIGNED TO MEET THE PERMIT REQUIREMENTS OF THE NPDES PHASE II PROGRAM SET BY THE EPA.

INSPECTION & MAINTENANCE

The Lane CFT is designed to accommodate a topside inspection and maintenance program. Measuring sediment depths and removing material accumulations can be accomplished through the manhole openings without physically entering the structure.

ACCESS RISERS ALLOW FOR INSPECTION AND MAINTENANCE.

REGULARLY SCHEDULED INSPECTION AND PROPER MAINTENANCE WILL HELP ENSURE THE LANE CFT WILL FUNCTION AS DESIGNED.



Treated flow characteristics decline as sediment depths increase. Since it is impractical to clean the unit after each rain event it is necessary to determine the depth of sediment at which removal rates become unacceptable. The general guideline is that sediment removal rates should be at least 80%, and the depth of sediment should not exceed 25% of the distance between the structure bottom and the weir crest.

DESIGN & DEVELOPMENT

The Lane CFT was developed using the widely accepted fundamental principles of Stoke's Law for determining the settling velocity of particles suspended in fluids. The outlet orifice is sized to release a typical first flush discharge, and regulates flow through the sediment chamber so that the laminar flow needed for Stoke's Law is realized.

In short, the vertical settling rate of a specified particle with a defined velocity requires a certain travel length in order to fall below the weir crest and be captured in the sediment chamber.

THE MAIN COMPARTMENT OF THE LANE CFT IS DESIGNED TO CAPTURE, STORE AND ACCUMULATE SEDIMENT, WHILE THE SMALLER COMPARTMENT RETAINS FLOATABLE DEBRIS, OIL AND RELATED BYPRODUCTS.

A general outline of the design process used to determine the size of the Lane CFT needed to achieve the desired sediment removal is as follows:

1. Use Stoke's Law to determine the vertical settling velocity ($V_{settling}$) of the smallest particle specified for removal (units are chosen to produce a settling velocity in feet per second).

$$V_{settling} = \frac{2gr^2(\gamma_1-\gamma_2)}{9\mu}$$

(Stoke's Law)

g = ACCELERATION OF GRAVITY
r = RADIUS OF PARTICLE
γ_1 = DENSITY OF PARTICLE
γ_2 = DENSITY OF WATER
μ = VISCOSITY OF WATER

2. With the settling velocity known, calculate the time required for the particle to settle the minimum vertical distance necessary for capture ($T_{settling} = D_{min}/V_{settling}$). The minimum settling distance in feet, denoted as D_{min}, is equal to the inlet diameter plus 2".

3. Using the defined treated flow rate (Q_{treat}) and the cross-sectional area of the sediment chamber (A_{SC}), determine the velocity through the sediment chamber ($V_{SC} = Q_{treat}/A_{SC}$).

4. With the velocity through the sediment chamber known, calculate the length of the sediment chamber needed to accommodate the particle settling time ($L_{SC} = V_{SC} \times T_{settling}$).

5. Use the orifice equation to determine the outlet needed to throttle the flow to the defined treated flow rate. The value of the orifice coefficient depends whether an orifice plate is used (c = 0.62) or a standard sized outlet pipe is used (c = 0.82).

$$Q_{treat} = cA(2gh)^{1/2}$$

(orifice equation)

$$d = \left[\frac{4Q_{treat}}{c\pi(2gh)^{1/2}}\right]^{1/2}$$

c = ORIFICE COEFFICIENT
h = ORIFICE HEAD
A = ORIFICE CROSS-SECTIONAL AREA
d = ORIFICE DIAMETER

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CFT MODEL SELECTION

A particular model is chosen based upon the treated flow requirements and the size of the smallest particle to be removed from the runoff. Normally there are two different sizes of particles specified for removal, 140 sieve particles (0.0042") and 200 sieve particles (0.0030"). **With parameters defined a CFT model is designed to remove a minimum 85% TSS (Total Suspended Solids).**

Changing the diameter and length of the mainline segment for each of the standard inlet and outlet sizes available produces numerous combinations, each with its own unique flow characteristics. The tables below identify some of the treated flow capabilities attainable for each Lane CFT model by varying the size of the inlet and outlet.

Treated Particle Size, 140 Sieve

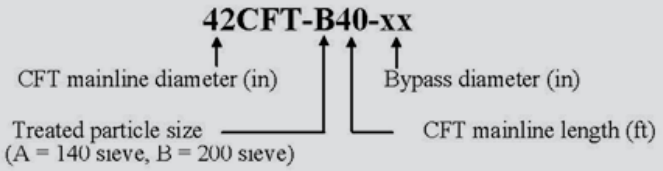
CFT Model No.	Treated Flow Rate (cfs)	Mainline Diameter (in)	Mainline Length (ft)	Inlet Diameter (in)	Outlet Diameter (in)
36CFT-A20-xx	1.12	36	20	10	6
36CFT-A40-xx	3.11	36	40	12	10
42CFT-A20-xx	1.88	42	20	10	8
42CFT-A40-xx	4.22	42	40	12	12
48CFT-A20-xx	2.74	48	20	10	10
48CFT-A40-xx	4.95	48	40	15	12
60CFT-A20-xx	4.22	60	20	12	12
60CFT-A40-xx	7.19	60	40	15	15

Treated Particle Size, 200 Sieve

CFT Model No.	Treated Flow Rate (cfs)	Mainline Diameter (in)	Mainline Length (ft)	Inlet Diameter (in)	Outlet Diameter (in)
36CFT-B20-xx	0.99	36	20	8	6
36CFT-B40-xx	1.88	36	40	10	8
42CFT-B20-xx	1.12	42	20	10	6
42CFT-B40-xx	2.10	42	40	12	8
48CFT-B20-xx	1.24	48	20	12	6
48CFT-B40-xx	3.11	48	40	12	10
60CFT-B20-xx	2.10	60	20	12	8
60CFT-B40-xx	3.59	60	40	15	10

It should be noted that standard sizes can accommodate most flows. However, the design can be adapted to an even wider range of flow requirements with the installation of an orifice plate specifically designed for the actual treated flow requirement. Please contact your Lane representative for assistance in selecting the appropriate specification to meet the needs of your site.

LANE CFT MODEL NOMENCLATURE



SUMMARY FEATURES AND BENEFITS OF LANE'S CFT WATER QUALITY UNIT

- Manufactured from high quality Lane corrugated HDPE pipe
- Removes suspended particles, oils, grease and other floatable debris
- Designed to remove a minimum 85% TSS
- Designed to accommodate a topside inspection and maintenance program via manhole risers
- No mechanical, moving or replacement parts required
- Extended travel path to provide laminar flow characteristics
- Dividing full height weir to isolate turbulent flow at the inlet
- Watertight couplers and pipe joints
- Lightweight, installation friendly, durable, chemically inert and abrasion resistant
- Less costly and more efficient then comparable products
- Bypass system that allows treated flow requirements to be met while remaining capable of passing the design storm

STANDARD SIZES CAN ACCOMMODATE MOST FLOWS. HOWEVER, THE DESIGN CAN BE ADAPTED TO A WIDE RANGE OF FLOW REQUIREMENTS.

Related Information Available From Lane:

- CFT Installation Guide
- CFT Maintenance Guide
- CFT Standard Engineering Drawings

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