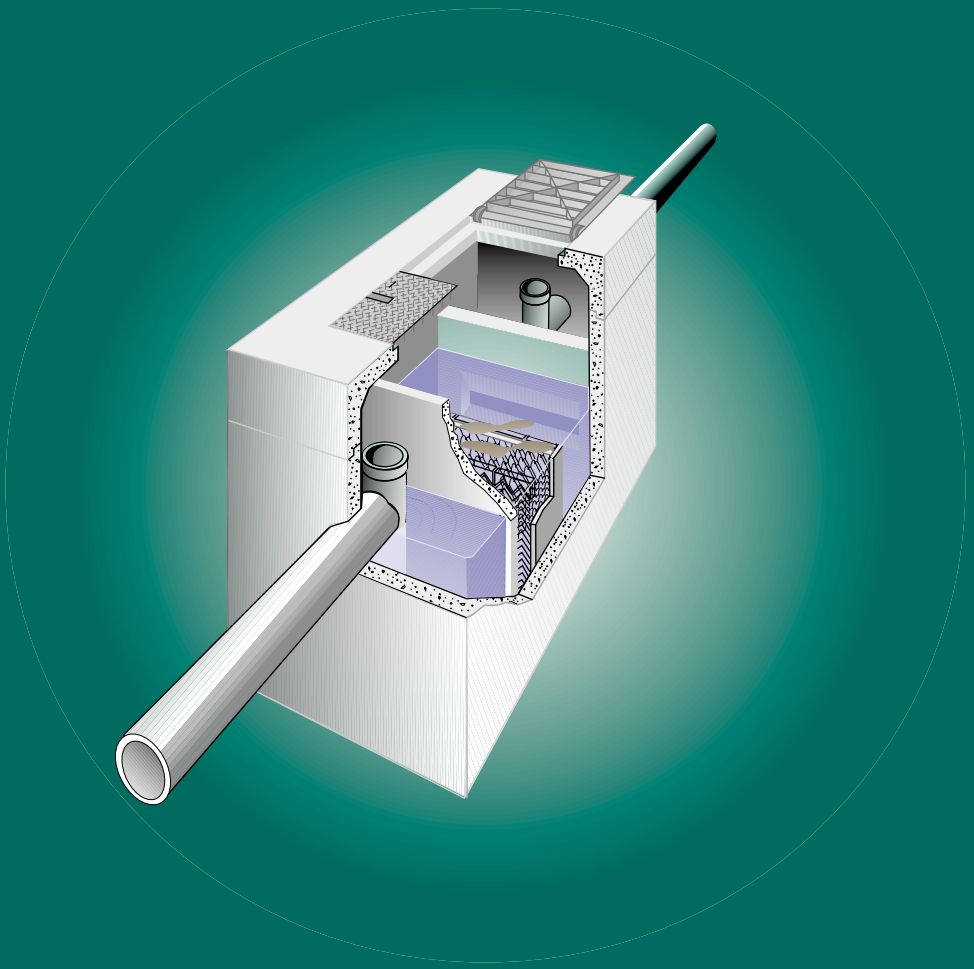
Oil-Water Separators

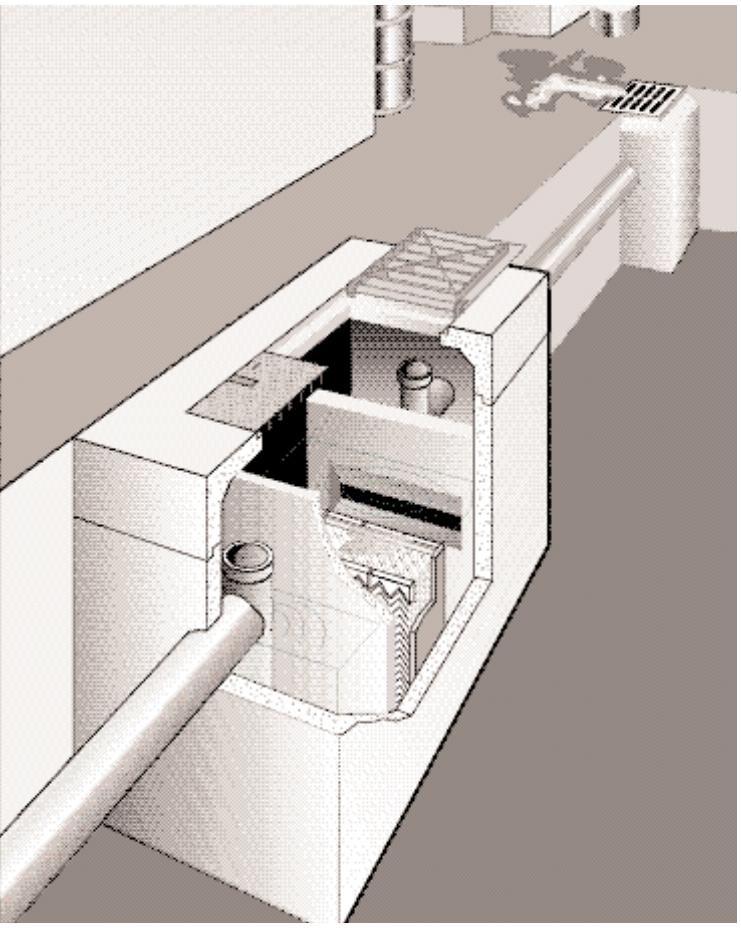
Environmental Protection
from Surface Water Pollution



Oldcastle Precast®

The [redacted] Coalescing-Plate Oil-water separator

for Durability, Performance and Servicability



. Precision-formed, high quality reinforced concrete retention structure

—Nothing compares to an Oldcastle precast vault that is specially designed for the strength, water-tightness and the durability needed for water-treatment structures

. Modular M-Pak™ Coalescing Plate Stacks

—the state-of-the-art in coalescing plate design
—provide more horizontal separation area in a smaller volume than any other available media
—specially formed for continuous self-clearing of oil and solids to make maintenance easier; easily upgraded

. Large double doors

—in cast aluminum or galvanised steel; capable of supporting the H20 vehicular loading
—allow easy daylight inspection and regular cleaning without entry
—enable convenient servicing using wet vacuum equipment
—allow transfer of large components and equipment

. Optimum configuration of baffles and openings

—developed after extensive trials and test-runs and in-house hydraulic analysis
—promote evenly distributed laminar flow conditions throughout separation chamber for optimum performance

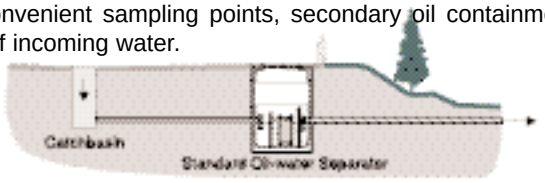
. In-flow Control Chamber

—Dissipates turbulence
—Collects heavy grits and floatable debris.

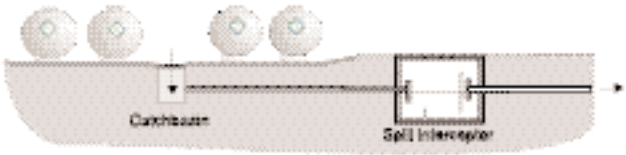
. Tee-sections at both inlet and outlet

—provide convenient sampling points, secondary oil containment and full venting of incoming water.

High Efficiency / High Performance Unit
installed with grit chamber upstream



Standard Treatment Unit -restricted flows
(Deep Installation with risers)

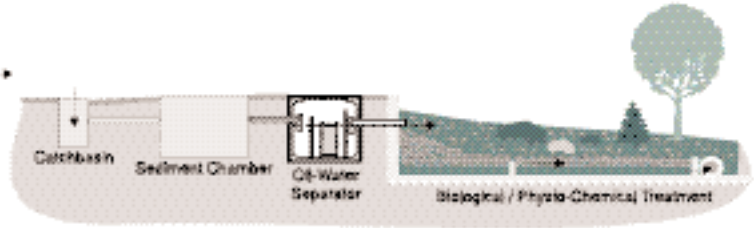


Spill interceptor installation
- upgradable to higher-performance water treatment

Oldcastle's oil-water separators meet the needs of a wide range of run-off applications:

- High performance removal of fugitive oil from storm and washdown water,
- Interception capacity for accidental surface releases
- Enhanced pretreatment for biological and physio-chemical purification systems

Stormwater Treatment with
upstream diversion of large flows



Upstream protection of biofiltration treatment systems

When you put all of the pieces of the puzzle together, the advantage of Oldcastle's separator becomes clear.

The Challenge of a Real Environmental Problem

Where most of the oil in water comes from:
It is a well known fact that chronic hydrocarbon contamination of surface water results more from small quantities of oil from regular *fugitive* sources than from large accidental spills. Fugitive sources include leaking containers, machinery, vehicles and similar releases that are difficult to avoid.

How much is too much?
Current environmental water quality standards for oil and grease are frequently set at levels as low as 5, 10 and 15 mg/liter†. This is about half a teaspoon of oil in a 55 gallon drum of water.

What oil in stormwater looks like:
Because much of the oil that gets into water is quickly broken up into tiny droplets, you often don't notice it at all. Only when you inspect a sample of water can you make out tiny spheres. In fact droplets of oil range in size from one or two to several hundred microns‡. In many cases this means that to meet effluent standards, separators have to at least be capable of removing all droplets of oil down to 50 or 60 microns and this is not easy.

Why traditional spill interceptors won't work:
Traditional spill interceptors —simple retention tanks with baffles to trap floating oil on the surface— play a useful *secondary containment* role in the event of a large accidental spill. However, unless they are extremely large they are unlikely to safeguard normal stormwater discharges from exceeding today's stringent standards for oil and grease. Small oil droplets separate very slowly from water and are more likely to pass right through one these vessels.

The Real *Science* of Oil-water Separation

What is gravity oil-water separation?
Oils are hydrophobic which means that they do not dissolve in water. Instead, when oil is well mixed with water, it exists as a near-suspension of tiny spherical droplets. Oil is lighter than water and for this reason, even though an oil droplet may be smaller than your eye can see, it rises up (slowly) in the water. Gravity separation is achieved, therefore, by creating the right conditions (*laminar flow*) in a flow-chamber where these droplets are given enough time to reach a horizontal surface where they will no longer be carried along by moving water.

Isaac Newton's laws of fluid and particle mechanics accurately describe the behaviour of these droplets (He didn't just discover gravity, you know). Because of his laws we know that these oil-droplets rise at constant speeds (or "terminal velocities"). They do not accelerate (for the same reason that parachutists do not continue to accelerate beyond a "terminal velocity" when they are falling to earth). Harvey Stokes is specifically responsible for deriving the accurate mathematical formula (known as "Stokes' Law") that we use for calculating the rising (or falling) velocity of tiny spherically shaped objects like oil-droplets.

How long does it take for oil to separate?
Stokes' law tells us how quickly (or slowly) small oil-droplets rise. A 60 micron droplet typically takes half an hour to rise a distance of just one foot in still water. So one of these is unlikely to get trapped on the surface of a simple retention vessel unless the vessel is extremely large (and provides plenty of retention time) or the water flow-rate is kept low.

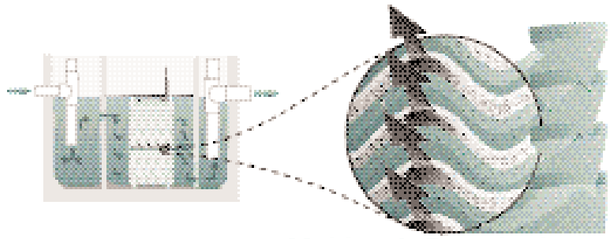
Horizontal Separation Area
Besides Newton and Stokes, many engineers have made important contributions to the science of separation processes —none more so than Allen Hazen at the beginning of this century. He is attributed with the discovery of the principle of "surface loading": that the effectiveness of a simple gravity separation device is directly proportional to the area (on plan) of the separation (or sedimentation) chamber divided by the flow-rate. This is true for all liquid gravity separation processes. It is because of Hazen's principle that we know that a if a retention vessel is to continuously remove droplets as small as 50 and 60 microns from water, it will have to an area on plan of *at least* 4 square feet for every GPM* of flow through it.

Hazen, confirmed that the performance of a separator is *independent* of the depth of water in the separation tank. As early as 1904, he suggested the value of dividing a chamber vertically using a large number of horizontal plates to increase performance —increasing what we refer to as horizontal separation area.

Achieving High-Efficiency Gravity Oil-Water Separation

The Simple idea of Coalescing Plates
The first coalescing plates were just flat panes of glass stacked in a tank: dividing the water into many thin layers. Because glass is hydrophobic, oil tends to adhere to it whereas water does not. Modern coalescing plates are made with durable, tough plastics, like polypropylene, that have the same property. Though corrugated and inclined (to improve serviceability), the principle is exactly the same. When water flows through a separation chamber with coalescing plates spanning its cross-section, it gets divided into may thin layers. Each layer acts like an individual separation chamber with droplets only having to rise as far as the underside of one of the plates to be "caught".

Squeezing more horizontal area into a smaller separator.
Oldcastle provides more plates in a smaller separator volume than anyone else. Using Facet's M-Paks we can provide as much as 31 square feet of horizontal separation area in a single cubic foot.
Combine this with the hydraulic integrity of a well designed, space-efficient, rectangular concrete vault and you have the most efficient separator ever developed!



Making It Practical

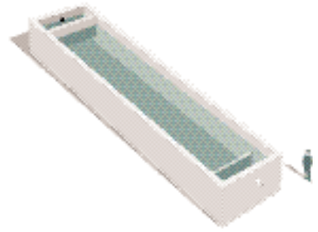
If you can't maintain it, you don't want it
Although high performance is necessary for safeguarding today's effluent standards, it is not enough. Everyone knows that water treatment systems are only going to work as well as they are serviced and maintained. That is where Oldcastle's oil-water separator once again stands out. The key advantage of going with a vault design —long favoured by engineers in the field of water treatment— is that you can look inside and inpect the separator while it is operating. The film of oil that develops is easily skimmed off the surface of the water using standard wet/dry vac equipment. Sludge can be removed using regular septic tank pumping equipment.

Gravity separation — not filtration!
Coalescing plate separators are gravity separation devices —not filters. Even though stacks of coalescing plates appear to occupy a large amount of space inside the separation chamber, they do not reduce the area of the flow cross-section significantly and do not result in a significant pressure-drop. In addition, to avoid plugging, the coalescing plates Oldcastle uses have been designed with inclinations and channels to enable solid particles that settle out in the plate-stacks to slide to the bottom of the chamber. The oil collects on the underside of the coalescing plates and gradually forms a film that flows upwards — eventually making its way undisturbed to the water surface in the separator chamber. In other words, gravity works with the plates to allow them to self-clear.

What it means to have a more efficient oil-water separator:

When you can get the same oil-removal performance with this —

...that you could previously only get with this —



...You have a number of extra advantages...

What are you going to do with all that extra space ?

† The concentration of pollutants, like oil, is nearly always measured in milligrams per liter (mg/l). The less precise term "parts per million" is used to mean the same thing. Environmental regulations invariably use mg/l to set water quality standards.

‡ What's a micron? A micron is a measure of length used to measure very small distances. One micron (or micrometer) is one thousandth of a millimeter or one inch divided by 25,400. 50 microns is the approximate limit of detection for the human eye — the thickness of a fine hair.

* Flow-rate is currently measured in GPM (Gallons per Minute). 1 GPM = 0.00223 CFS (Cubic feet per second) = 3.788 l/min. (liters per minute) = 63.1 x 10^{-6} m^3/s (meters cubed per second).

The contamination of our water resources with hydrocarbons is an especially difficult problem to solve because of the widespread use of petroleum products. For reasons such as this, the influence of NPDES (National Pollutant Discharge Elimination System) is spreading to more and more industries and businesses including those in the commercial and retail sectors. An effective surface-water pollution prevention strategy of some kind will eventually be required of every business that manages its own property.

To meet this need, Oldcastle has developed a very special oil-water separator: designed for run-off situations where oil-contamination from fugitive sources is an ongoing risk. Unmatched for its oil-removal effectiveness, compactness, and functional layout, Oldcastle's separator sets the standard for this environmental technology.

Oldcastle's coalescing-plate separator is like no other separator being sold today. See for yourself the advantages that make it the best product of its kind:

- *The highest oil-removal performance achievable with energy-efficient gravity-based technology.*
- *State-of-the-art, modular, low-maintenance separation media* —easily removed and retrofitted and allow future upgrading
- *Precision-formed, high-quality, reinforced-concrete construction* —ideal for below-grade installations (access doors can support heavy vehicular loading)
- *Entry into the separator is not necessary for inspection and maintenance* —No confined space worries!
- *Complete exposure of internals through large, easily opened access doors* —regular inspection and timely service easily managed
- *No special equipment or additional attachments necessary for inspection, monitoring and servicing needs*
- *Non-corrosive materials used throughout* —no need to worry about a rusting tanks (separators are exempt from federal requirements for Underground Storage Tanks)
- *Occupies minimal landspace*

The best available technology for oil-water separation brought to you by Oldcastle

Oldcastle's own team of technical staff will help you with:

. Specifying performance criteria for your site

. Material specifications for your application

. Managing unusual or severe on-site loading conditions

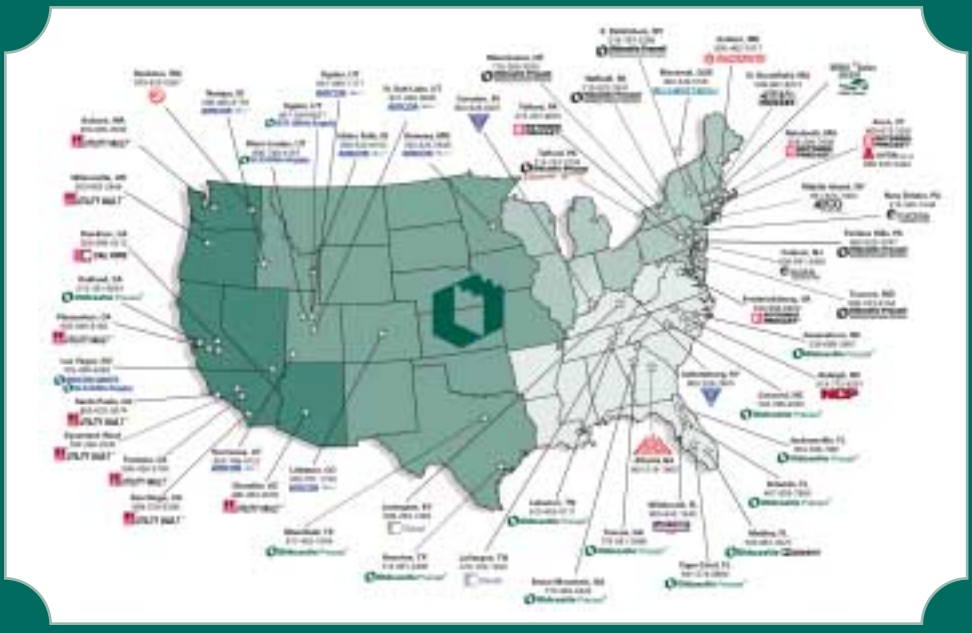
. Special containment needs in sensitive locations

. Drainage-system compatibility issues

Applications:

Vehicle maintenance facilities
Truck stops
Petroleum marketing facilities
Auto recycling and repair yards
Railway maintenance yards
Industrial plants
Refineries
Waste disposal and transfer depots
Vehicle / equipment washdown sites
Airfields and aircraft maintenance
Marine repair yards
Vehicle and equipment storage pools

Manufacturing plants are located throughout the country



Contact your nearest Oldcastle Precast® representative for advice or a quotation today.

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