Murky Volume

for CARRARA 7, 8 Version 0.47

Murky Volume is a volumetric effect for Carrara. It attenuates light though the volume and can interact with a surface above and zones within.

To install the plugin extract the contents of the compressed zip package into the Carrara\Extensions sub-folder. Optionally create a \Sparrowhawke3D\ subfolder to manage all the plugins. To remove the Murky Volume plugin users must delete the MurkyVolume.mcx, MurkyVolume.dat and MurkyVolume.txt files.

Macintosh users should open the Carrara installation folder (typically /Applications/Carrara). Right-click on the Carrara application and then choose "Show Package Contents". Navigate to "Contents/MacOS/Extensions" then copy the the MurkyVolume.mcx, MurkyVolume.dat and the MurkyVolume.txt files into that folder.

Using the Murky Volume Plugin
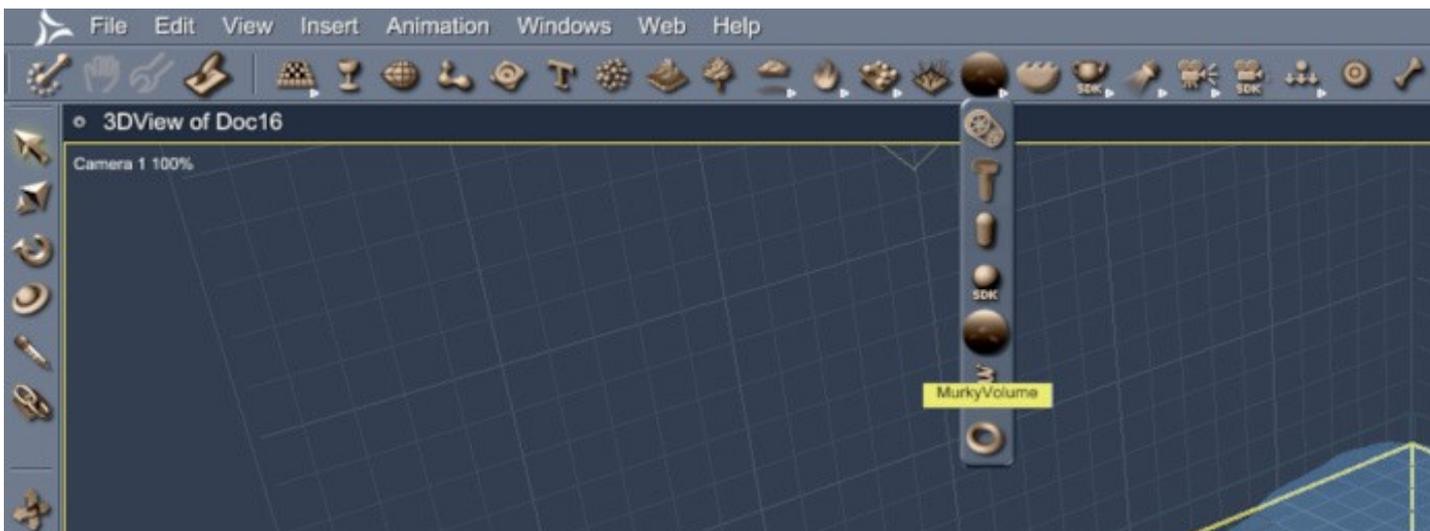
Add the Murky Volume into a scene then adjust the size and depth to fill the area required. The Dimensions should be set to a greater or equal amount of the Maximum Visibility distance for a large body of water. Do not change the scale of the volume in the scene.

Add a Surface object, typically the Ocean primitive, for the volume to interact with. The Surface must cover a slightly larger area than the X and Y dimensions of the volume. The top of the surface must be beneath the top of the volume or there will be unexpected results.

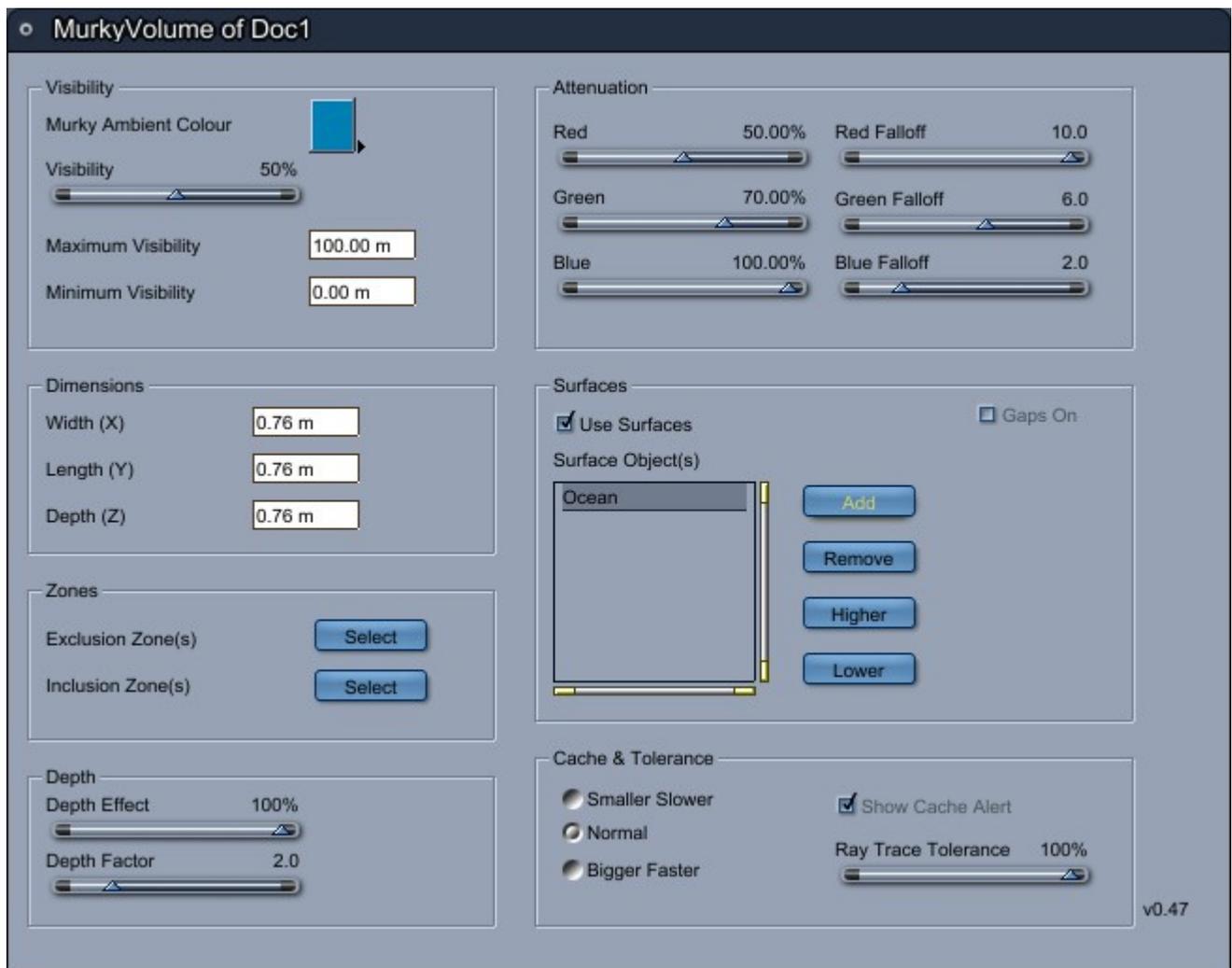The Murky Volume can be used without a surface.

Any Murky Volume master cannot be duplicated with the current version. If the scene has multiple volumes each must be a master object.
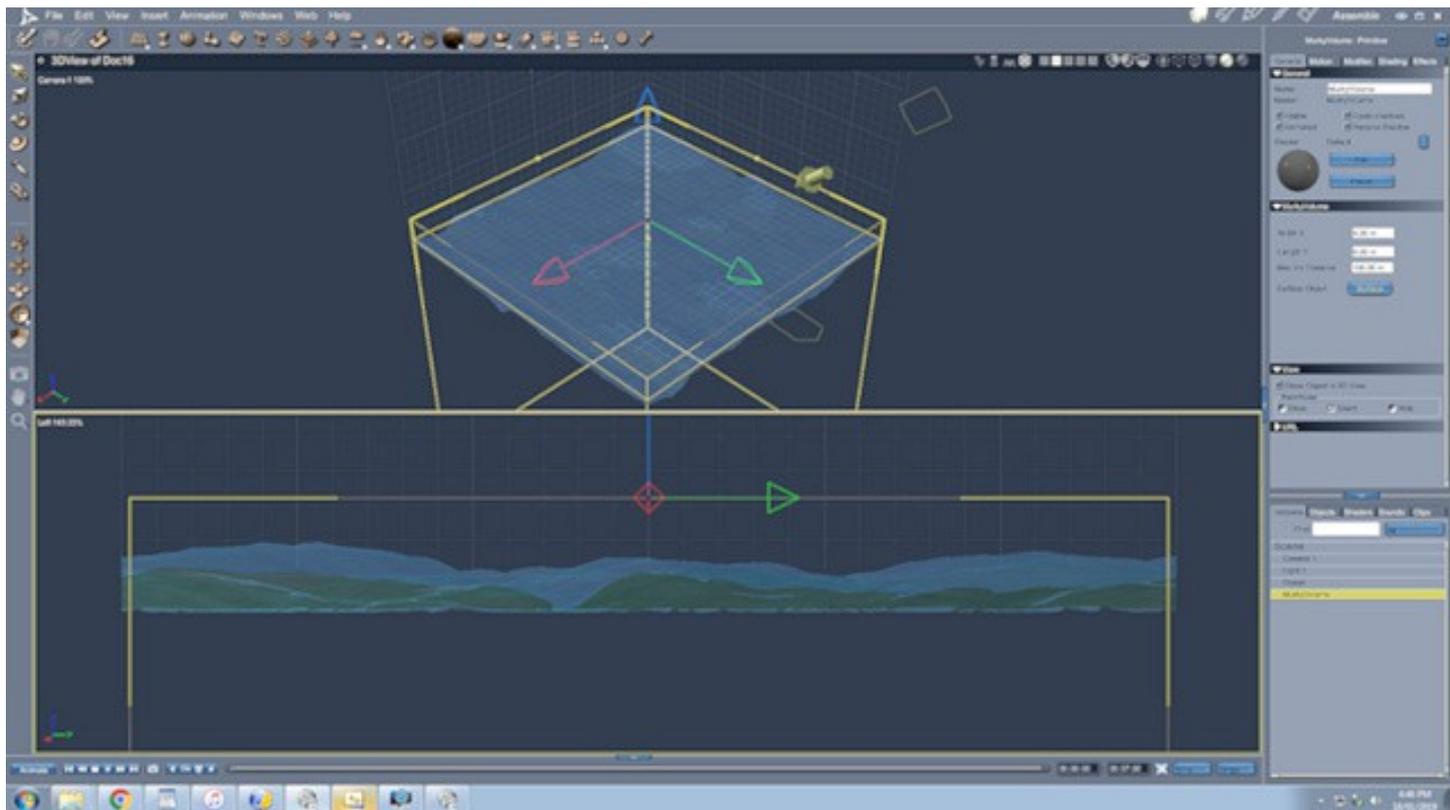

The Murky Volume default values are set for use with the default Ocean Primitive in that version of Carrara.

All of the contents of the scene that are below the surface must be placed within the volume in order to be rendered properly. When the ray trace hits the edges of the volume it will return the ambient colour of the volume at that depth.

Parameters

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Visibility
Murky Ambient Colour
Visibility   50%
Maximum Visibility   100.00 m
Minimum Visibility   0.00 m

Attenuation
Red   50.00%   Red Falloff   10.0
Green   70.00%   Green Falloff   6.0
Blue   100.00%   Blue Falloff   2.0

Dimensions
Width (X)   0.76 m
Length (Y)   0.76 m
Depth (Z)   0.76 m

Surfaces
☑ Use Surfaces   ☐ Gaps On
Surface Object(s)
Ocean   Add
                 Remove
                 Higher
                 Lower

Zones
Exclusion Zone(s)   Select
Inclusion Zone(s)   Select

Depth
Depth Effect   100%
Depth Factor   2.0

Cache & Tolerance
⦾ Smaller Slower   ☑ Show Cache Alert
⦿ Normal
⦾ Bigger Faster   Ray Trace Tolerance   100%

v0.47

The **Murky Ambient Colour** is the colour seen near the surface when a ray of light has travelled the maximum visibile distance though the volume. When the ray of light comes from deeper beneath the surface it will become darker and darker as the light is attenuated. For perfectly pure deep water in a lake this colour should in fact be almost black.
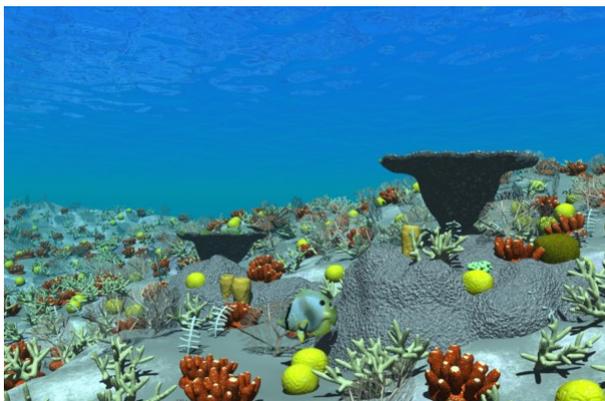

Color HLS 53,35,96 RGB 3,144,175
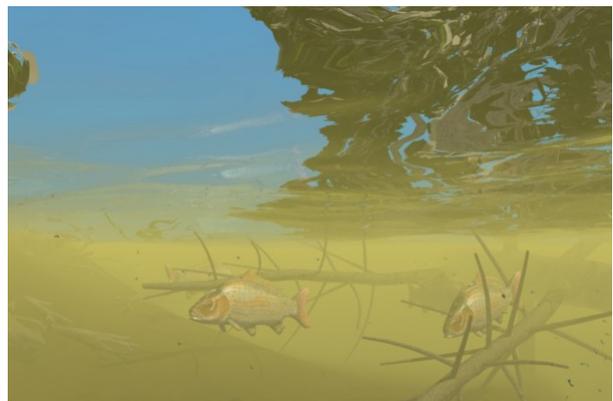
Color HLS 15,40,56 RGB 159,148,45

The **Visibility** setting controls how far through the water the ray of light can pass before the ambient colour of the water takes over. The value is a % of the Maximum Visibility distance. This can be used to make the water more turbid at the surface without changing the Maximum Visibility which also controls the maximum depth.
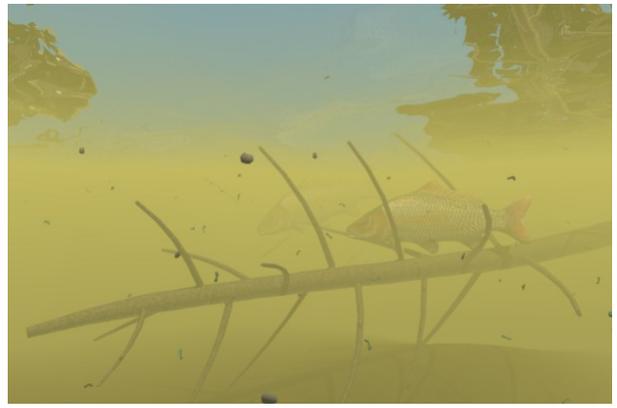
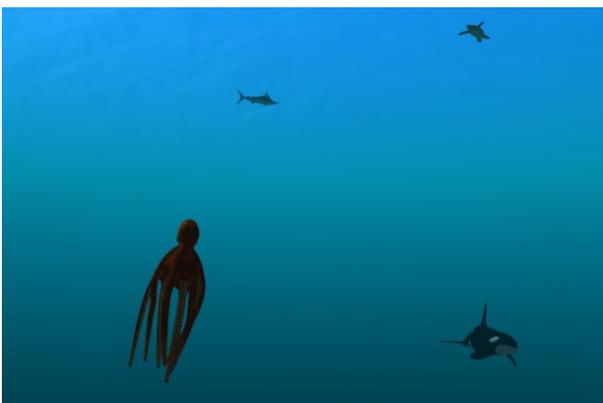Visibility 75%   Visibility 50%

The **Maximum Visibility** distance is the most important value and determines how far and to what depth light will penetrate the volume. For realistic results this should be set to 100m for oceans and up to 200m for very clear water in a deep lake. For turbid waters where the clay and muck has been stirred up reduce the distance to 10s of metres. Adjust the Visibility setting to increase the turbitity at the surface without having to change the murky depths. If the dimensions of the volume are smaller than the maximum visibility then the render will give unexpected results.

Maximum Visibility 100m   Maximum Visibility 50m

The **Depth Effect** setting can be used to change the way the Murky Ambient Colour is applied at depths. When the Depth Effect is at 100% the ambient colour of the water will be black when the depth is at the Maximum Visibility distance. If the Depth Effect is reduced the ambient colour will be brighter even at the maximum depth.

The **Depth Factor** adjusts how rapidly the ambient colour gets darker as the water gets deeper. A value of 1 will give a linear response. Values less than 1 will allow for lighter ambient colours in the depths and values greater than 1 will make the water get darker as the view descends into the depths..

The **Minimum Visibility** can be used to set a distance where no attenuation is applied to the ray of light.

The **Ray Trace Tolerance** sets the accuracy used in calculations of the surfaces and zones in the volume. At real world sizes this should be left at 100% to reduce artefacts.

The **Cache** settings can be adjusted to use more or less memory when processing the zones and surfaces.

Attenuation Settings

When a ray of light passes through a volume of water the different colours of the spectrum are absorbed at different rates. All light will be fully absorbed at depths of 200m in clear water. Light in the red end of the spectrum will be absorbed at half that depth. The Red, Green and Blue settings are applied as a percentage of the Maximum Visibility distance. The falloff values determine the exponential curve of the absorption. Red light is absorbed more rapidly than blue light.

Surfaces

Use the Add button to add a new surface to the list. Surfaces that are higher up in the list are given priority where they intersect or overlap. The top of any surface must be below the top of the Murky Volume. To change the list select a surface then use the Remove button.

Uncheck the Use Surfaces option (or remove them all from the list) to render the volume without surface interactions.

To create a continuous surface place an ocean primitive with a zero edge formula deformer* at the same height as a plane or infinite plane with a zone falloff shader in its alpha channel and the same zone multiplied against its reflection and transparency colors. This will create a hole in the plane where the ocean primitive sits. Using the alpha channel alone does not stop all lighting effects in a shader. The zone falloff can use a cube primitive the same size and location as the ocean primitive. Parenting the cube to the ocean will allow it to move and change the zone with it.
> *The zero edge formula is as follows:
>> radius=sqrt(x*x+y*y);
>> divide=(radius-p1)/(1.0-p1);
>> answer=(radius>p1) ? (1.0-divide) : 1);
>> value=((radius>1) ? 0 : answer);
>> dz=z*value;

Inclusion Zones

When an Inclusion Zone is selected only areas within the zone will contain the volume. The zone must be a closed volume or the results will be unexpected. The Inclusion Zone must be smaller and surrounded by the Murky Volume. The actual Inclusion Zone can be invisible in the scene so long as there are matching surfaces to be involved in the ray tracing.
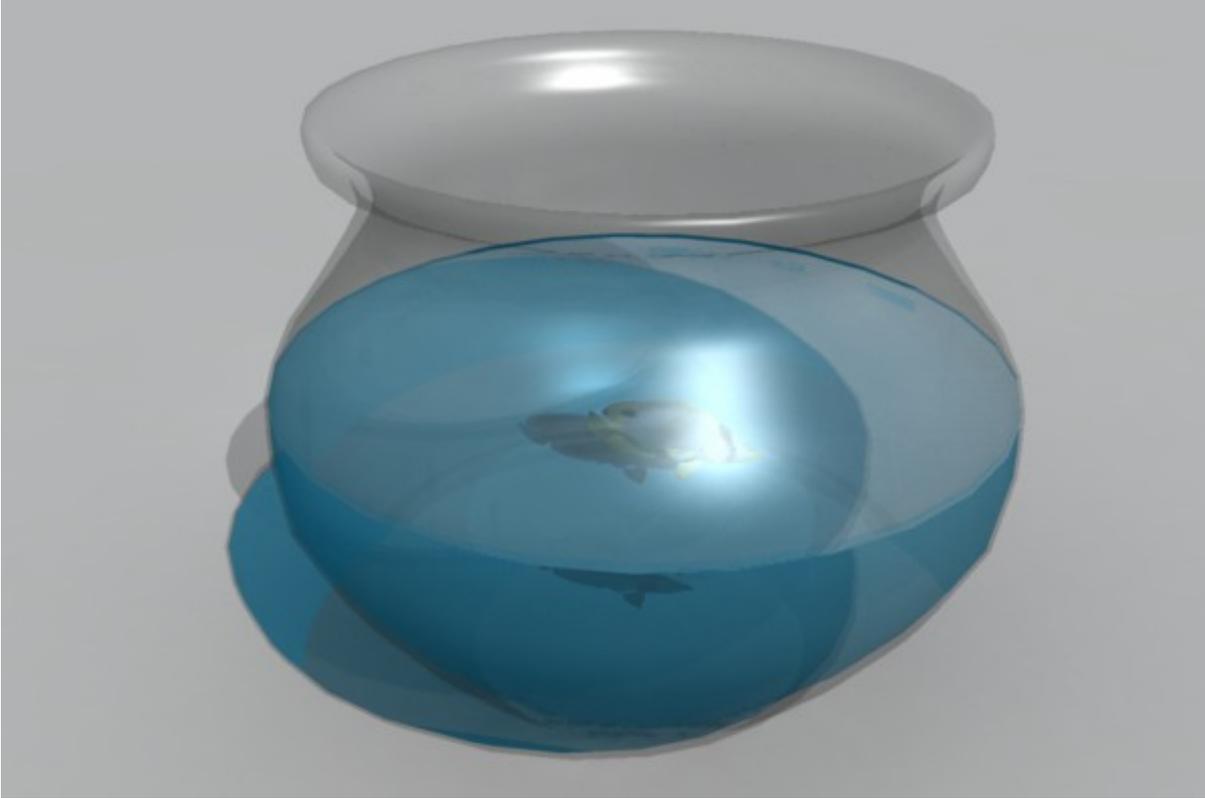
Exclusion Zones

Objects inside an exclusion zone will be considered as vessels or containers of air. The zone must be a closed volume or the results will be unexpected. Use the exclusion zone to create a tunnel in an aquarium or interior of a submarine or submersible.

Surface Shader Settings

The surface object used to interact with the Murky Volume will need to have its shader channels adjusted for best results. These recommended settings are made following the rule that the Color, Reflection and Transparency settings should add up to a maximum of 100% Lightness/Intensity.

Color

The Color channel should have the same Hue and Saturation as the Murky Ambient Colour but with a lower Lightness. The more clear the water is the lower the intensity should be in the color channel. For more turbid, dirty, polluted or coloured waters there will be more diffuse light coming off the surface and less transparency.

Reflection

The Reflection channel should use a Color sub-shader set to match the Hue and Saturation of the colour used as the Murky Ambient Colour but have the Lightness increased to 85-90%. This will adjust the intensity of the reflections and make the slight colour change to them expected.

Set the Fresnel Term to 95% effect so that when the view is above the water there will be almost no reflections seen and when the view is along the water it will be highly reflective.
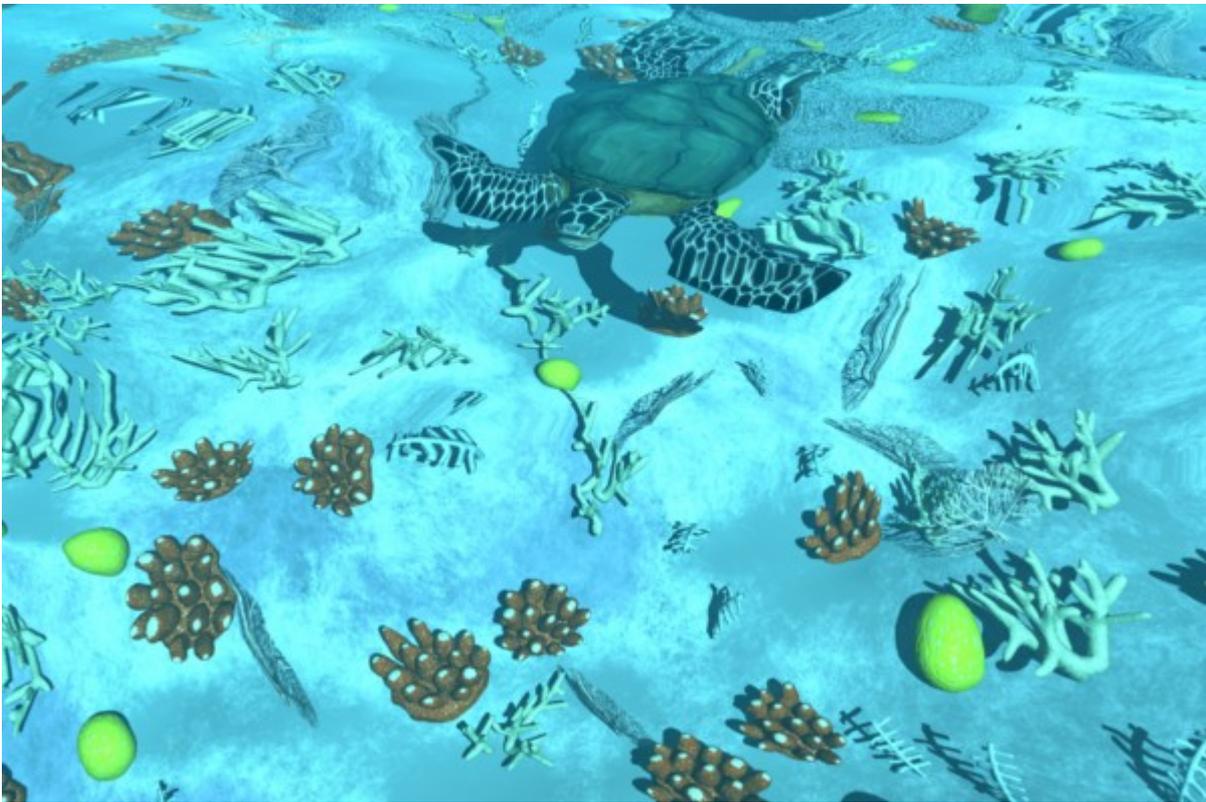
Transparency

The Transparency Intensity sub-shader should be set to use the same colour used in the Murky Ambient Colour with a higher intensity. For perfectly clear water this will be almost 100% white. For coloured, polluted waters less light will penetrate the surface and the Transparency Intensity should be reduced by adjusting the HLS.

Set the Fresnel Term to 95% effect so that when the view is above the water it will be more transparent but almost opaque when at a distance or when viewing along the level of the water.

In the Transparency channel Absorption and in-scattering should be disabled by unchecking the Use Absorption box. The Murky Volume will attenuate the ray and change the colour based on its depth. In-scattering will not work when the camera is beneath the surface and create inconsistent results. Set the Absorption value to 0% to disable it if in-scattering is required.

The Fresnel Term does not effect the intensity of the light through the Transparency into the volume.

Ocean Reef
Murky Ambient Color HLS 53, 35, 96%
Multi Channel Color HLS 53, 10, 96%
Reflection Color HLS 53, 85, 96% Fresnel Term 95%
Transparency Color HLS 53, 85, 96% Fresnel Term 95%

River in Summer
Murky Ambient Color HLS 32, 40, 30%
Multi Channel Color HLS 32, 20, 30%
Reflection Color HLS 32, 80, 30% Fresnel Term 95%
Transparency Color HLS 32, 80, 30% Fresnel Term 95%

Turbid Lake
Murky Ambient Color HLS 15, 40, 56%
Multi Channel Color HLS 15, 30, 56%
Reflection Color HLS 53, 70, 56% Fresnel Term 95%
Transparency Color HLS 53, 70, 56% Fresnel Term 95%

Scene and Render Settings

Caustics will work within the volume.

Scene Ambient should be set as normal for the world above the Murky Volume. In an animation or scene that plunges into the depths the Ambient light should gradually be turned down to 0% Brightness.

Known Issues

- Parameters in the mini-ui don't work properly and have been removed.
- Volumes and surfaces are limited to the Global Z axis for depth calculations.

Tips and Tricks

- Shading what is near and under the water is important, wet sticks and rocks, mosses should look different.
- Place an open boat at the top of the surfaces list

Planned and Possible Improvements

- a 3D shadow buffer to detect or create darker areas under shelves and in grottos
- sun beams in the volume
- improved accuracy with zones
- allow for volumes to work in local mode

Support

The Murky Volume is part of the user supported Patreon project.
https://www.patreon.com/Sparrowhawke3D. Any new version with improved features will first be available with a subscription. A free version of the Murky Volume plugin will be released on my website.

You can use it in any project, commercial or otherwise. You may not repackage, redistribute or sell the Murky Volume plugin.

For bug reports, comments, feedback and suggestions email me, Jeremy@Sparrowhawke3D.com.