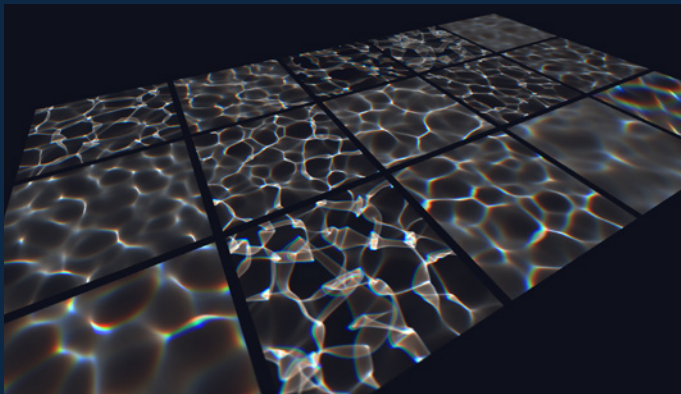


# Water Caustics Effect for URP v2

English / [日本語](#)

## Water Caustics Effect for URP v2

This asset contains two modules Texture Generator & Effect.



### ■ Water Caustics Tex Generator [ URP / HDRP / Built-inRP ]

Generate realistic caustics animated textures at run-time by simulating waves and light refraction with Compute Shader.



### ■ Water Caustics Effect [ URP 3D ]

Easily add the water caustics effect to the scene.  
(for Universal Render Pipeline 3D)

[ **Unity 2020.3 / 2021.3 / 2022.3 supported** ] (Tested on Unity 2020.3.20f1, 2021.3.33f1, 2022.3.22f1)

[ **PC / MAC / iOS / Android / Switch / Quest2 tested** ]

[ **DX11,12 / Metal / Vulkan / OpenGL / GLES3.1 supported** ]

※ Unity 6 or higher is not supported. It will be supported in V3.

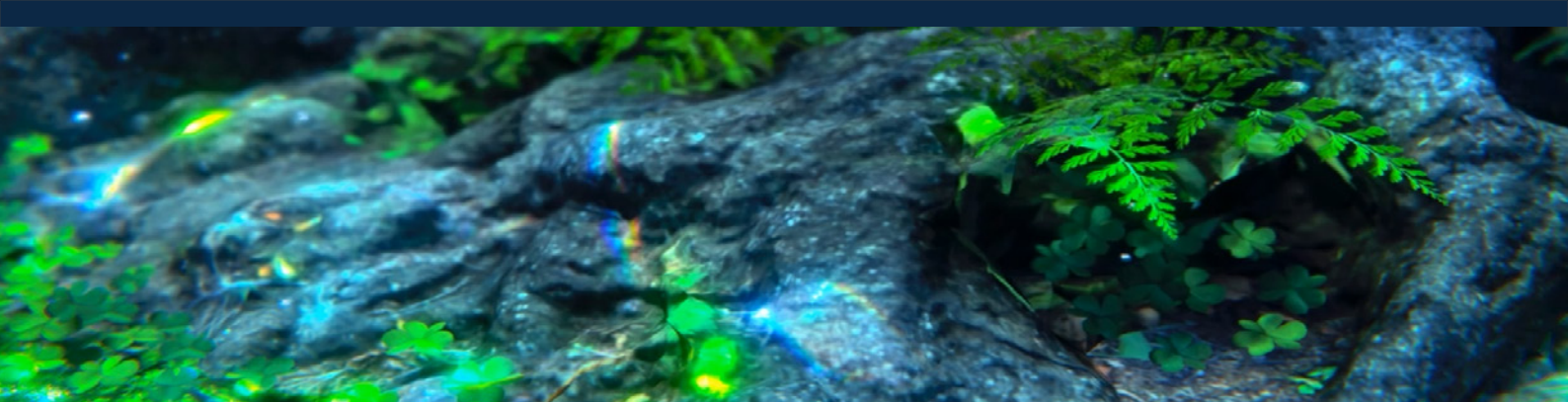
※ WebGL is not supported because the Compute Shader cannot be used.

※ All code is included.

※ If you encounter problems, please refer to [Troubleshooting](#) page. If the problem persists, please contact [here](#).

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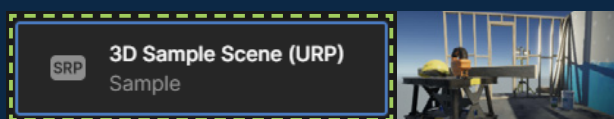


English / 日本語

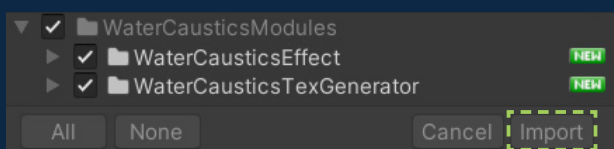
## Installation and Demos

1. When creating a new project, use the URP 3D template.

※ Unity 2020.3 or later is required.



2. Download and import the assets by referring to [this page](#).



※ In HDRP and Built-inRP, the WaterCausticsEffect folder is automatically deleted after import.

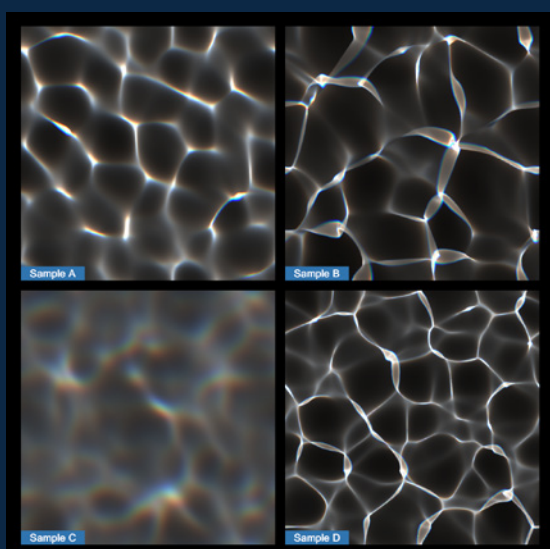
※ If updating it to a newer version, please delete the older version before importing.

3. Open the demo scenes.

[ URP / DRP / Built-inRP / Other ]

Tex Generator Demo

WaterCausticsTexGenerator / DEMO (TexGen)

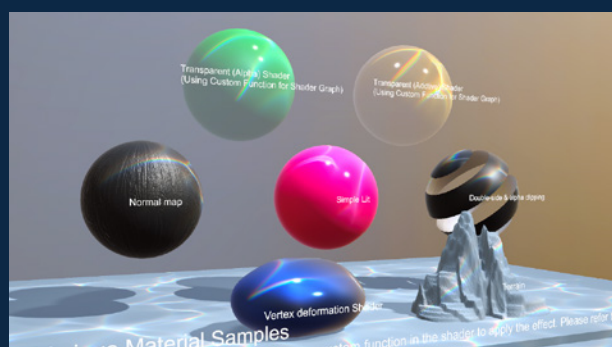
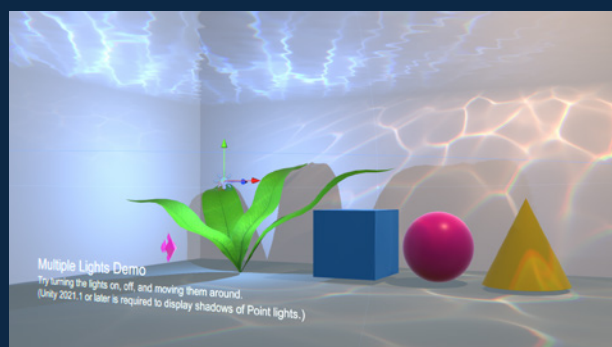
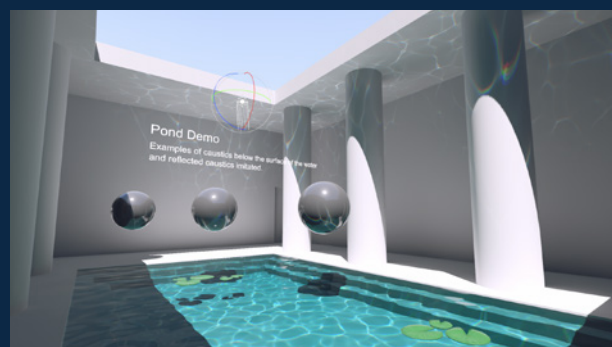


With HDRP and Built-in RP, only the texture generator can be used. Apply the output RenderTexture to [Light Cookie](#), [Decal](#), [Projector](#), or your own shader for use.

[ URP3D Only ]

Effect Demo

WaterCausticsEffect / DEMO (Effect)



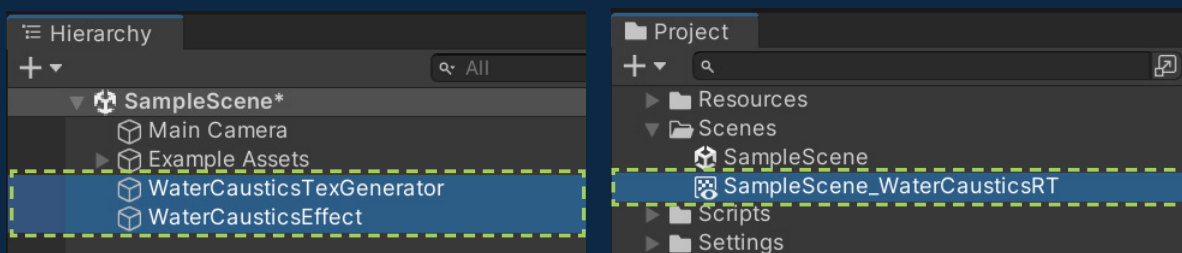
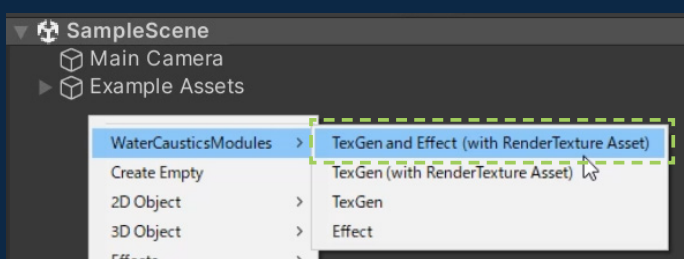




English / [日本語](#)

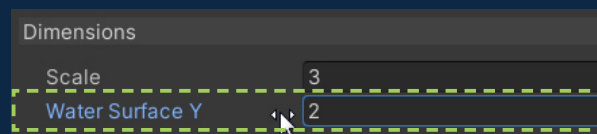
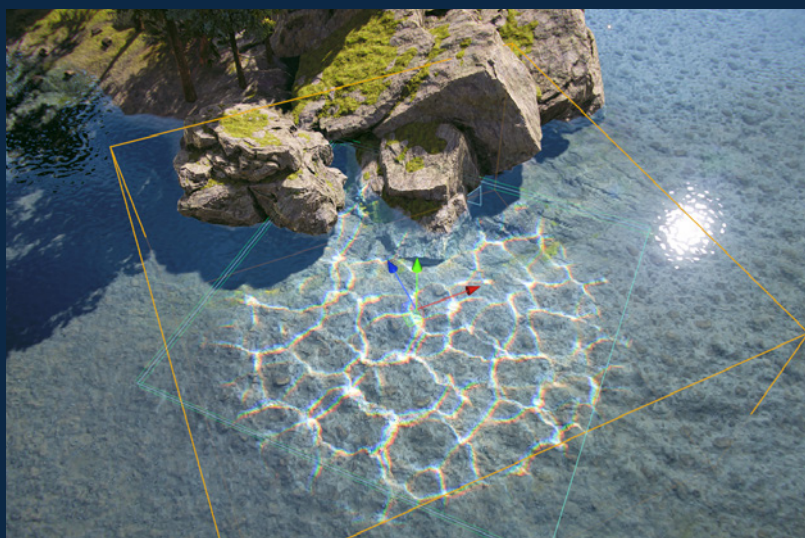
## Attach Effect to the Scene

1. Right-click on the Hierarchy window and select "WaterCausticsModules / TexGen and Effect (with RenderTexture Asset)".



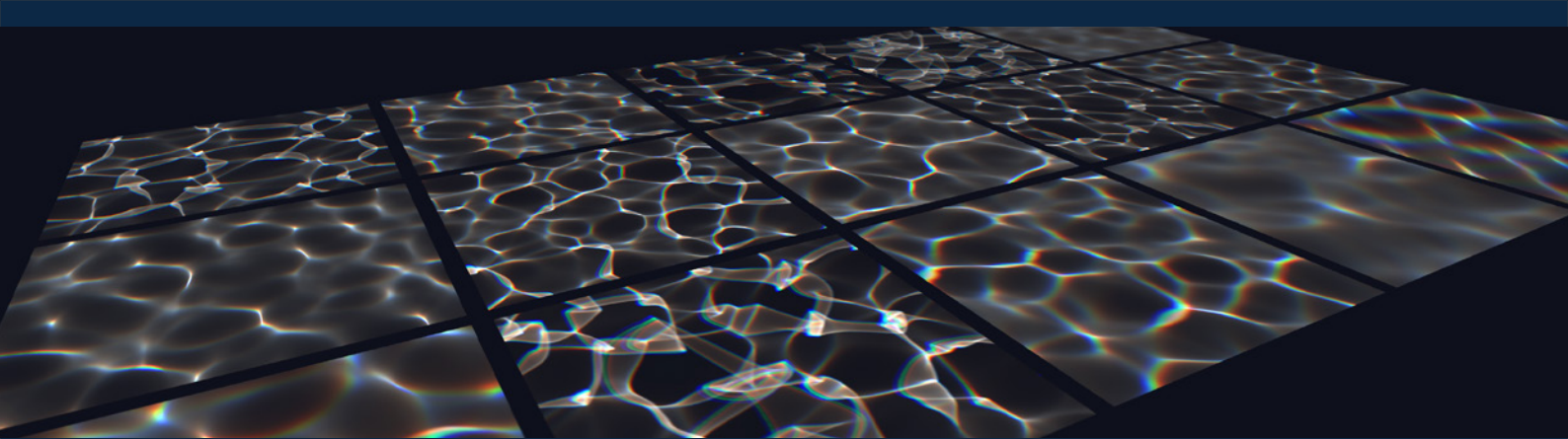
Two game objects are added to the scene, and a RenderTexture asset is created in the same folder as the scene file.

2. Select the WaterCausticsEffect GameObject and adjust the position and size and height of the water surface (Water Surface Y).



3. Then adjust the caustics pattern and movement with WaterCausticsTexGenerator and the strength of the effect with WaterCausticsEffect.

 [Youtube : How to Apply Effect to Scene](#)



# WaterCausticsTexGenerator Reference

[ [URP](#) / [HDRP](#) / [Built-inRP](#) ]

- Generates rich, realistic caustics animated textures at runtime by simulating waves and light refraction with Compute Shader.
- Any render pipeline (SRP, URP, HDRP, Standard) can be used.
- [Features] 4 Wave Layers, 3 Styles, Chromatic Aberration, Blur, Directional Blur, RGB Color Shift, Gamma, Brightness Adjustment, etc.

▼ Calculation

Render Texture

DEMO\_WaterCausticsRT

512x512 / MSAA8x / R16G16B16A16\_SFloat

Calc Resolution

160 x 160

Fill Gap

0.08

Animate In EditMode

✓

Open Preview

▼ Parameters

▼ Wave

Pause

✓

Density

1

Height

1

Speed

1

Flow

0.1

Direction

45

▼ Waves

▼ Wave [0]

✓

Density

5

Height

0.5

Fluctuation

1.05

Flow

0.17

Direction

100

► Wave [1]

✓

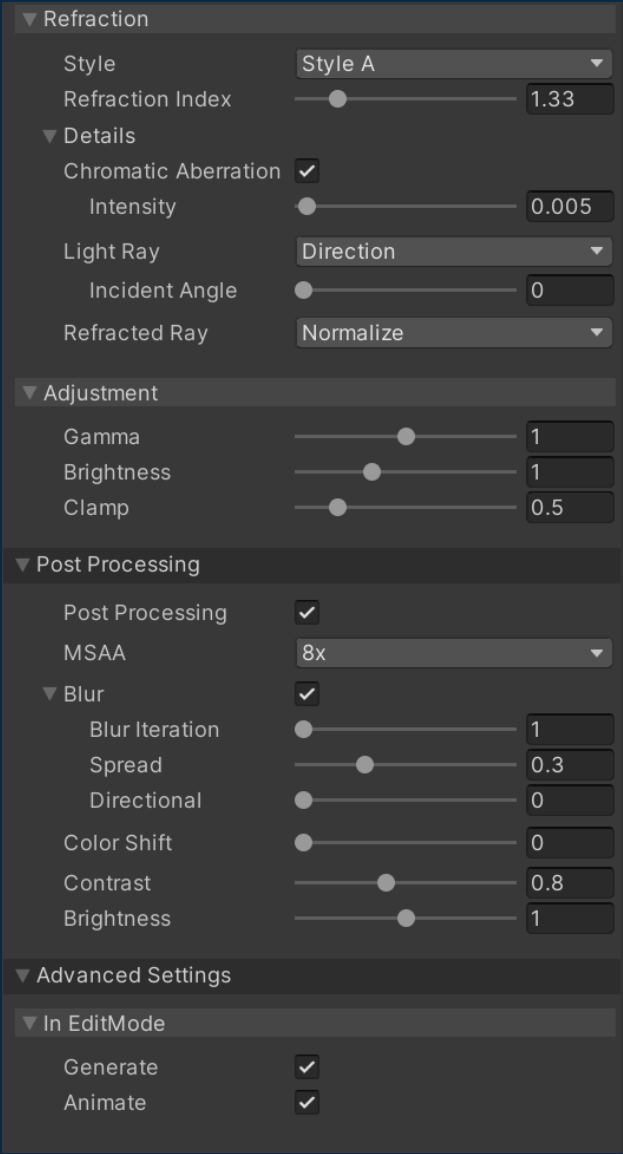
+

-

Calculation	
Render Texture	Output destination render texture.
Calculate Resolution	Resolution used for internal calculations.
Fill Gap	If the edges of the output image are not drawn, increase the value. Make it as small as possible to reduce the load.
Animate In EditMode	Animates waves and forces scene and game views updates while in edit mode.
Open/Close Preview	Open and close the preview window.

Wave	
Pause	Pause all waves.
Density	Adjust the overall density.
Speed	Adjust the overall speed.
Flow	Adjust the overall flow.
Waves	Wave settings. Supports up to 4.
Wave	Toggles this wave on and off.
Density	Density of wave.
Height	Height of wave.
Fluctuation	Amount of wave fluctuation.
Flow	Amount of wave flow.
Direction	Direction of wave flow.



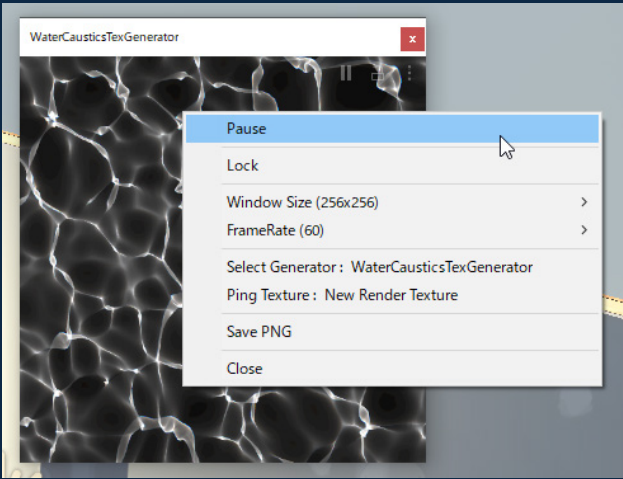


Refraction	
Style	How to calculate light focusing.
Refraction Index	Index of refraction.
Chromatic Aberration	Simulates chromatic aberration. The calculation is more expensive, so for mobile devices, consider using Color Shift instead.
Intensity	Shifts the refractive index in the RGB channels.
Light Ray	Specify the direction of the light ray.
Direction	Specified by direction and angle.
Vector	Specify by Vector. It is normalized.
Transform	Specifies the Transform of the light.
Sun	Use the sun setting in the Light Settings window.
Auto	Use the shader's global variable "_LightDirection".
Refracted Ray	Whether to normalize the rays or extend them to the bottom. If the light ray is oblique, there is a noticeable difference.

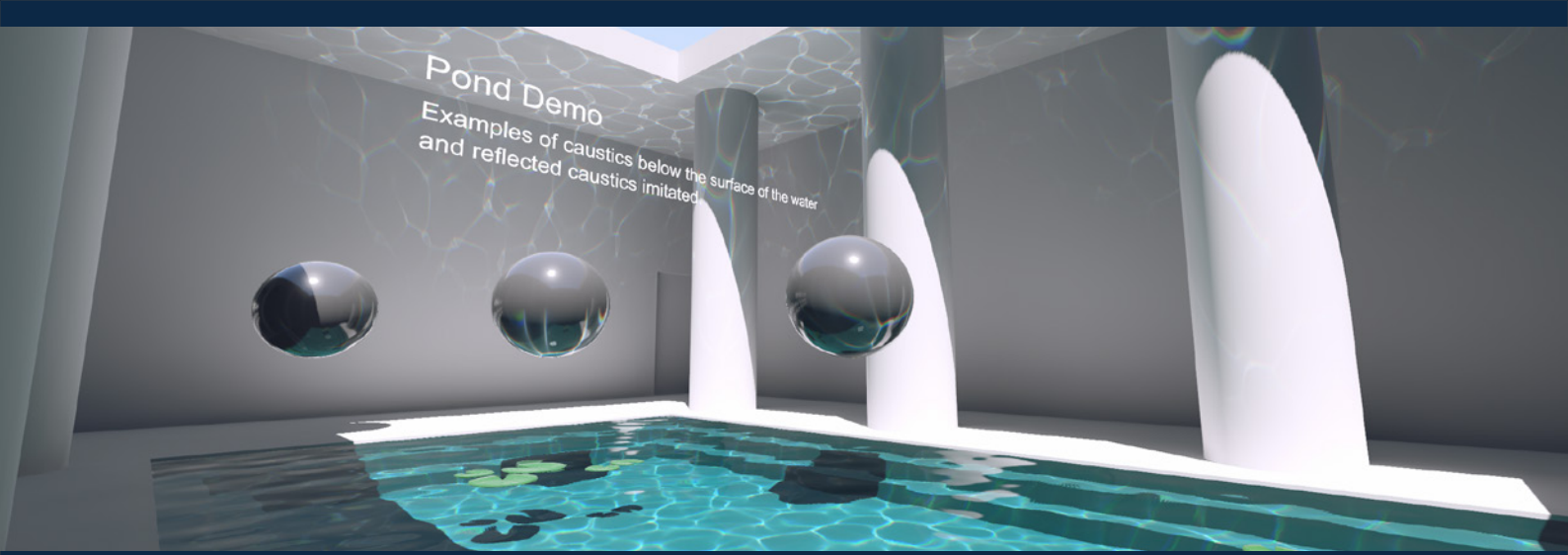
Adjustment	
Gamma	Adjusts the contrast.
Brightness	Adjust the brightness.
Clamp	Limit the brightness to this value.

Post Processing	
Post Processing	Post-processing ON / OFF.
MSAA	Multi sampling anti -aliasing.
Blur	Apply the blur effect.
Iteration	Number of iterations.
Spread	Amount of spread.
Directional	Directional blur.
Color Shift	Shifts the RGB channels to imitate chromatic aberration.
Contrast	Oblateness of blur spread.
Brightness	Adjust the brightness.

Advanced Settings / Editor	
Generate In EditMode	Whether to generate while in edit mode.
Animate In EditMode	Animates waves and forces scene and game views updates while in edit mode.



Preview Window / Context Menu	
Lock	Lock the generator to be previewed.
Window Size	Specifies the window size.
Select Generator	Select the generator.
Ping Texture	Tells the location of the render texture.
Save PNG	Save the image in PNG 8bit format.
Save EXR	Save the image in EXR 32bit format.
Close	Close the window.



English / [日本語](#)

# WaterCausticsEffect Reference

[ **URP (3D) only** ]

- VR supported.
- Forward, Forward+ and Deferred rendering supported.
- All parameters can be modified via scripts.
- It is also possible to apply individually by embedding custom functions in shaders. Use for transparent materials that are not rendered in depth textures, for example. (Shader Graph, HLSL scripting, and Amplify Shader Editor supported.)
- [Features] Range specification by Rectangle/Stencil/Image mask, Attenuation by Depth and Distance, Texture Random Tiling, Texture Rotation, RGB Color Shift, Transparency Effect, Drawing Timing Adjustment, etc.

▼ System

Effect Method

At Once

Normal Data

Camera Normals Tex (HQ)

Debug Info

☐

▼ Influence Scope

Layer

Default

Image Mask

☐

Custom Function

☐

▶ Draw Timing

After Rendering Skybox +1 (401)

Render Mask

Layer1

▶ Stencil Buffer

System	
Effect Method	Select method.
At Once	Draw effects using the camera's depth and normal textures.
Each Mesh (Legacy)	Draw effects for each mesh. Layer masks can be used. However, it cannot be applied to materials that are deformed by shaders.
Normal Data	How to get normal info. <a href="#">(At Once only)</a>
Generate from Depth (LQ)	Reconstructs from depth map. It's not good for smooth surfaces, but provides the correct normals.
Camera Normal Tex (HQ)	Use a normal map. It's good for smooth surfaces, but materials that do not support normal output, such as third-party shaders, may produce incorrect results.
Debug Info	Displays normal and other information for debug.

Influence Scope	
Layer	Layer this effect exists. It allows to specify to draw or not for each cameras.
Layer Mask	Layers to draw this effect. Objects on unchecked layers will be ignored. <a href="#">(Each Mesh only)</a>
Clip Outside	Draw effects only inside the volume. <a href="#">(Each Mesh only)</a>
Image Mask	Texture to use for masking.
Render Face	Which face to draw. <a href="#">(Each Mesh only)</a>

Custom Function	Whether to use custom functions.
Skip Scene View	Skip drawing in scene view.
Draw Timing	Draw timing settings. To be drawn in the Opaque-Texture of the system, it should be less than 400
Render Mask	Rendering Layer Mask setting. Lights to be affected can be specified. <i>(At Once only)</i>
Depth Buffer	Depth buffer operations. <i>(Each Mesh only)</i>
Stencil Buffer	Stencil operations. Refer to <a href="#">Unity Manual</a> . It is possible to ignore surfaces already drawn once, or to draw only surfaces that have been drawn with a specific material.

Caustics Effect

Texture

Caustics Texture

DEMO\_WaterCausticsRT

640x640 / R16G16B16A16\_SFloat

Channel

RGB

Rotation

15

Random Tiling

☒

Seed

0

Hardness

0.85

Rotation

0.02

Dimensions

Scale

3

Water Surface Y

2

Surface Fade

Start 0 End 0.5

Depth Fade

☒

Range

Start 0 End 50

Distance Fade

☒

Range

Start 30 End 100

Effect

Intensity

5

Main Light

☒

1

Additional Lights

☒

1

Shadow

☒

1

Color Shift

0.6

Direction

120

Light Color

0.2

Multiply Color

1

Normal Attenuation

1

Rate

1.5

Transparent

0

Backside Shadow

0

Advanced Settings

Renderer Feature

Auto-Management

☒

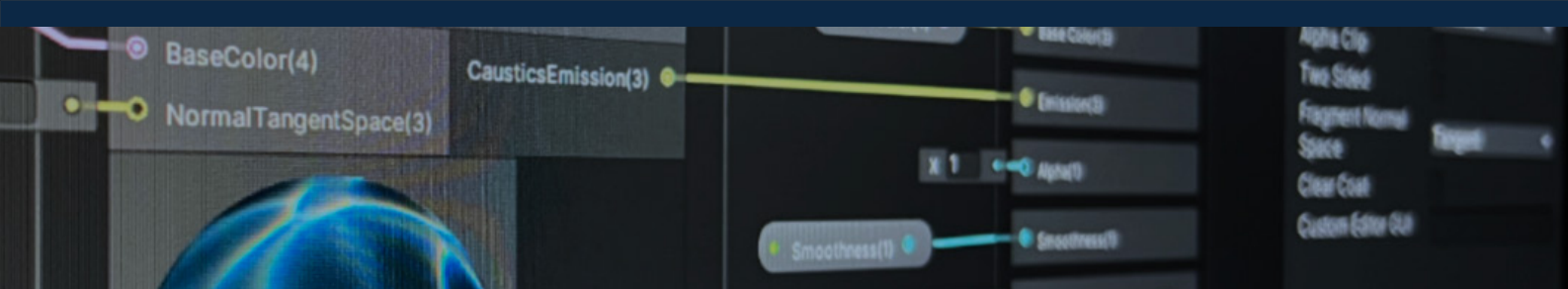
Caustics Effect / Texture	
Caustics Texture	Set the Render Texture specified as the output destination in the Texture Generator.
Channel	Color channels to be used. Using RenderTexture only R channel reduces the load.
Rotation	Rotate the texture.
Random Tiling	Tiling texture randomly to reduce unnaturalness caused by repetition of textures.

Dimensions	
Scale	Texture size at the height of the water surface.
Water Surface Y	Height of the water surface. Y-axis.
Surface Fade	Attenuation near the surface of the water.
Depth Fade	Attenuation by depth.
Distance Fade	Attenuation by distance from camera.

Effect	
Intensity	Intensity of effect.
Main Light	Intensity of the main light.
Additional Lights	Intensity of the additional lights.
Shadow Intensity	Intensity of Shadows.
Color Shift	Amount of RGB channel shift.
Direction	Direction of shift for RGB channels.
Light Color	Color intensity of the light.
Multiply Color	Multiplies the colors on the screen. 0 or 1 is a low load. To use a value between 0 and 1, Draw Timing must be set to 401 or later.
Normal Attenuation / Intensity	Attenuation intensity by angle between normal and ray. Lower values appear to transmit light.
Rate	Rate of attenuation. Larger values weaken the light on surfaces not facing the light direction.
Transparent	Intensity of light transmitted to the backside.
Backside Shadow	Intensity of shadow on the backside.

Advanced Settings / Renderer Feature	
Auto-Management	The Renderer Feature of this effect is automatically registered to the Renderer. A Renderer Feature is required to use this effect.






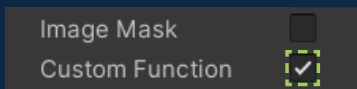
English / [日本語](#)

## Advanced Feature - Custom Function for Shader Graph

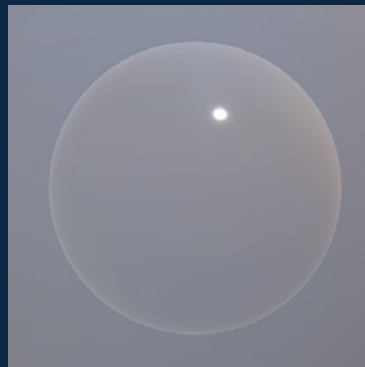
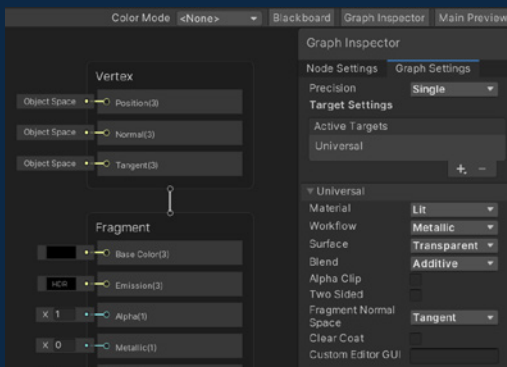
It is also possible to apply individually by embedding Custom Function in shaders.

Materials that are not rendered in depth textures, such as transparent textures, can be applied with this method.

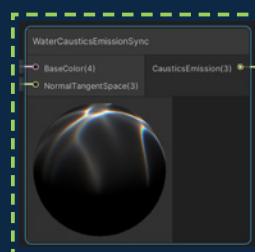
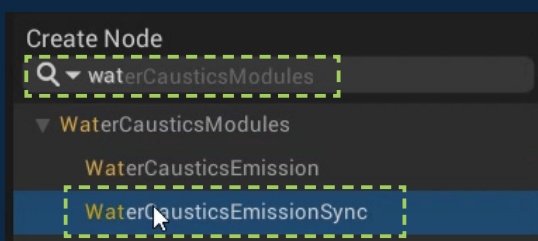
1. Turn on the Custom Function setting (System / Influence Scope) of the Effect.  [Youtube Video](#)



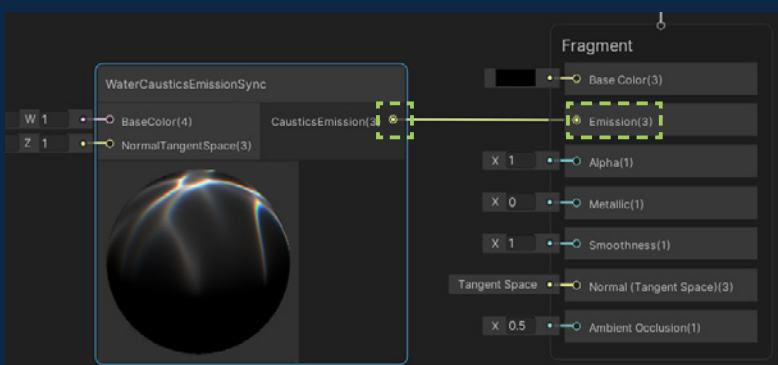
2. Open Shader Graph

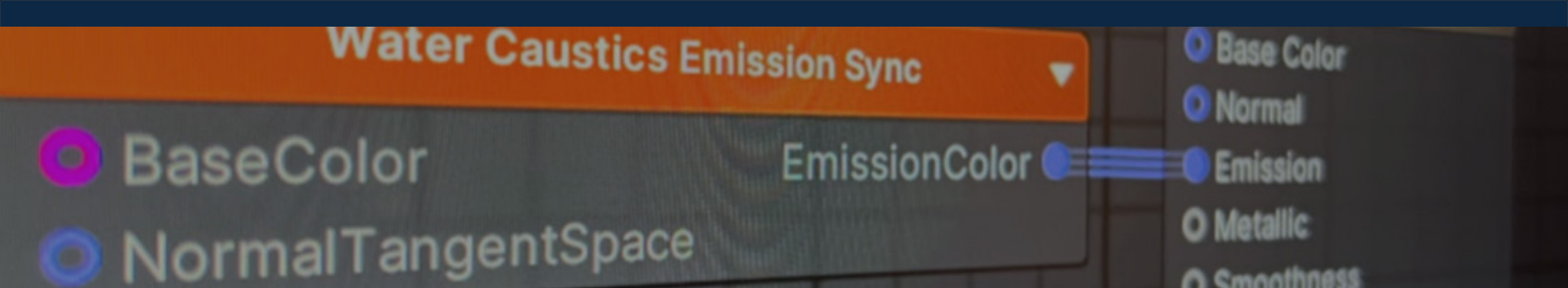


3. Press the space key to open the Create Node window, type "water", select WaterCausticsEmissionSync, and create it.  
(If you want more flexibility adjusting the effect, use WaterCausticsEmission.)



4. Connect the output to Emission and save the Shader Graph.





English / [日本語](#)

## Advanced Feature - Custom Function for Amplify Shader Editor

It is also possible to apply individually by embedding Custom Function in shaders.

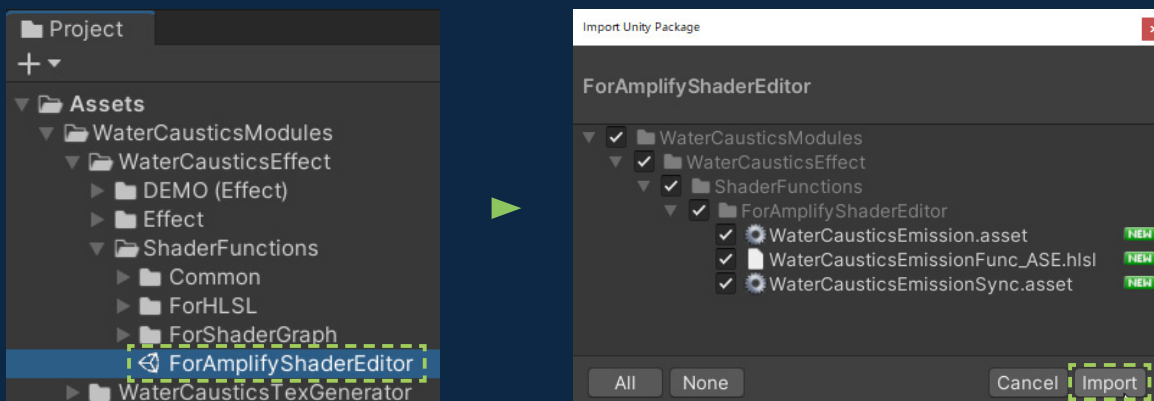
Materials that are not rendered in depth textures, such as transparent textures, can be applied with this method.

Amplify Shader Editor is a node-based shader creation tool. ([Asset Store Link](#))

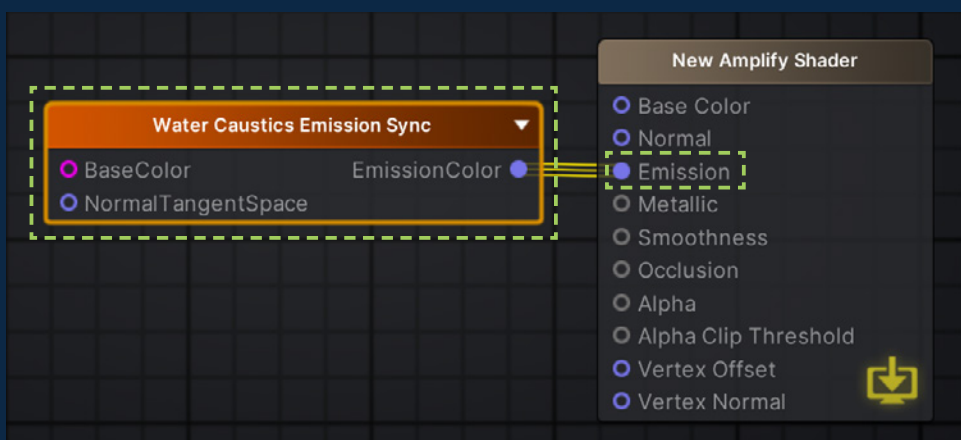
※ After updating this asset or moving this asset's folder, there may be a "HLSL file not found" error in the shader file. In that case, open the shader file on Amplify Shader Editor and re-save it.

1. Open the UnityPackage in the location shown in the image below.

※ If the Amplify Shader Editor was imported before this asset, it has been automatically imported.



2. After that, the process is the same as for [ShaderGraph](#).



```
HLSLPROGRAM
```

```
#include "Assets/WaterCausticsModules/WaterCausticsEffect/ShaderFunctions/ForHLSL/WaterCausticsEmissionFunc_HLSL.hls
```

```
#pragma multi_compile_fragment _ _WCE_DISABLED
```

English / [日本語](#)

## Advanced Feature - Custom Function for HLSL

It is also possible to apply individually by embedding Custom Function in shaders.

Materials that are not rendered in depth textures, such as transparent textures, can be applied with this method.

1. Include the custom function HLSL file. Copy and paste the following two lines under HLSLPROGRAM.

```
#include "Assets/WaterCausticsModules/WaterCausticsEffect/ShaderFunctions/ForHLSL/WaterCausticsEmissionFunc_HLSL.hls"
#pragma multi_compile_fragment _ _WCE_DISABLED
```

```
HLSLPROGRAM
#include "Assets/WaterCausticsModules/WaterCausticsEffect/ShaderFunctions/ForHLSL/WaterCausticsEmissionFunc_HLSL.hls"
#pragma multi_compile_fragment _ _WCE_DISABLED
```

2. Call the function in the fragment shader. The arguments are the world space position, normal, and base color.

```
half3 WCE_WaterCausticsEmissionSync(float3 WorldPos, half3 NormalWS, half3 BaseColor = half3(1, 1, 1));
```

```
half3 caustics = WCE_WaterCausticsEmissionSync(i.worldPos, i.normalWS, col.rgb);
col.rgb += caustics;
return col;
```

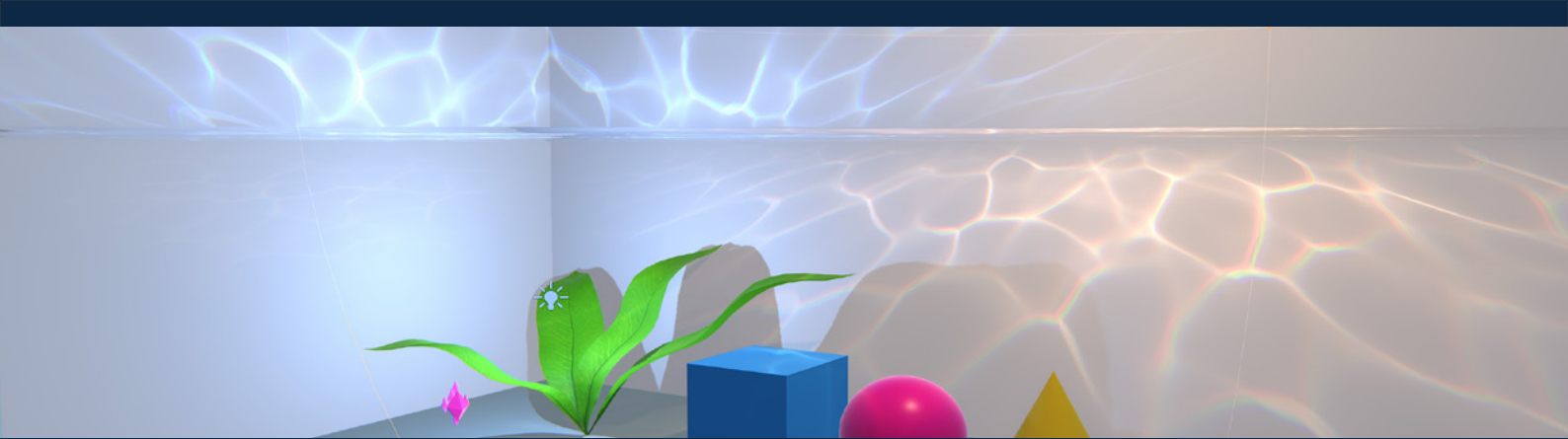
.....

If you want more flexibility adjusting the effect, use this function.

```
half3 WCE_WaterCausticsEmission (float3 WorldPos, half3 NormalWS, Texture2D CausticsTex, SamplerState CausticsTexSS,
float2 TexRotSinCos = float2(0, 1), int3 TexChannels = int3(0, 1, 2), bool UseTiling = false, int TilingSeed = 0, float TilingRot = 0,
float TilingHard = 0.85, float Density = 0.2, float SurfaceY = 2, float SurfFadeStart = 0, float SurfFadeEnd = 0.5,
float DepthFadeStart = 0, float DepthFadeEnd = 10000, half MainLitIntensity = 1, half AddLitIntensity = 1, half ShadowIntensity = 1,
float ColorShiftX = 0.4, float ColorShiftZ = -0.1, half LitSaturation = 0.2, half NormalAtten = 1, half NormalAttenRate = 2,
half TransparentBack = 0, half BacksideShadow = 0);
```

.....





# Troubleshooting

## ■ Errors occur after importing assets.

1. Please make sure that your Unity version is 2020.3.XX, 2021.3.XX or 2022.3.XX. Unity 2019 or earlier and Unity 6 or later are not supported.
2. In HDRP and Built-in RP environments, delete the "WaterCausticsModules/WaterCausticsEffect" folder if it exists.
3. Delete this asset and re-import it.
4. Try this asset in a newly created URP (3D) template project and see if the error occurs. (If not resolved, please [contact me](#).)

## ■ Errors occur after updating Unity.

1. Delete this asset and re-import it.
2. Try this asset in a newly created URP (3D) template project and see if the error occurs. (If not resolved, please [contact me](#).)

## ■ Effects no longer appear.

1. Please check the Intensity, Water Surface Y, and Influence Scope settings of the Effect component.
2. Please make sure that there are valid lights on the scene. The WaterSurfaceY setting must be between the light source and the object.
3. Please make sure the Effect layer is checked in the Culling Mask settings for the camera and lights.
4. Check if it is not in the shadow cast by another object. Or, try turning off the shadow setting of the Effect component.
5. Try changing the Effect Method and Normal Data settings in the Effect System settings. Also, turn DebugInfo ON and test if the normals of the world space are displayed.
6. If the effect disappears when other effects are used, it may be that the effect needs to be drawn before \_CameraOpaqueTexture is prepared. Please adjust the Draw Timing settings.
7. Please make sure that the WaterCausticsEffectFeature has been added to the RendererFeatures list in the RendererData asset.
8. (Unity2021 or later) Try switching the Rendering Path setting (Forward, Forward+, Deferred) in the Renderer Data asset.
9. Please re-import this assets and check that the demo scene is working correctly. (If not resolved, please [contact me](#).)

## ■ Effects are not rendered or displayed incorrectly on certain materials.

1. In the case of transparent materials, the effect cannot be applied without modification because they are not rendered in the depth texture. Embedding a custom function in the shader (see [p.9-11](#)) to apply the effect.
2. If the material is deformed by the shader, the effect cannot be applied using the Each Mesh method. Use the At Once method or embed a custom function in the shader (see [p.9-11](#)) to apply the effect.

3. If the effect cannot be applied (or is displayed incorrectly) only with the At Once method and Camera Normal Tex (HQ), the material's shaders may not support normal texture output. To apply effects, modify the shader to be the same as other methods while checking the Normal in the Debug Info display, or embed custom functions in the shader (see [p.9-11](#)), or change the method of the effect.
  4. If not resolved, please [contact me](#).
- 

■ Effects are drawn multiple times on a particular surface.

1. Using the Each Mesh method, this problem may occur when objects are overlapped in the same location or when multiple materials are applied to a single surface. This can be solved by using the At Once method or using a stencil mask to skip pixels that have been drawn once. If using a stencil mask, set Comp to Equal and Pass to IncrementSaturate in System / Influence Scope / Advanced / Stencil Buffer.
- 

## Contact

If you encounter any problems that cannot be solved by [Troubleshooting](#), please contact me. I will try to fix it as soon as possible.

URP specifications are still in flux. Therefore, please be aware that it may not work when the version of URP is upgraded.

It would be greatly appreciated if you could let me know if you notice this. I will try to fix it as soon as possible

Please let me know the following information.

1. **Detailed situation** :  
(Screenshots would help me understand the details.)
2. **Effect Method settings** : At Once / Each Mesh
3. **Normal Data settings** (At Once method only): Camera Normal Tex (HQ) / Generate from Depth (LQ)
4. **Rendering Path settings** (Unity 2021.1 or later): Forward / Forward+ / Deferred
5. **This asset version** :
6. **Unity version** :
7. **URP version** :
8. **Graphics API** :
9. **Build target** :
10. **Invoice number** (starting with IN on invoice email) :

Email: [support\\_asset@hacoapp.com](mailto:support_asset@hacoapp.com)

Twitter: [@m\\_hakozaki](#)