HORIZON BASED
AMBIENT OCCLUSION

by Michaël Jimenez

USER GUIDE

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1. Introduction

Horizon Based Ambient Occlusion (HBAO) is a post processing image effect to use in order to add realism to your scenes. It helps accentuating small surface details and reproduce light attenuation due to occlusion.

HBAO delivers more accurate AO compared to the other SSAO solutions available on the asset store, and this without any compromise on performances. This algorithm is highly optimized to use minimal GPU time and offers the best quality to performance ratio.

HBAO is compatible with both forward and deferred rendering as well with Universal Render Pipeline, and artifact free with forward rendered SpeedTrees and foliage. Source code included in the package.

The effect is scalable in order to achieve the proper performances.
With Color Bleeding feature. HBAO is Gaia extension ready.

2. Requirements

HBAO is fully compatible with Unity builtin and scriptable render pipelines.

Shader Model 3.0 compatible hardware is required (All Nvidia cards since GeForce 6 series, all AMD cards since R500/X1xxx Series and Intel since GMA 3150).

3. Usage

In order to use this image effect in Standard render pipeline, just add HBAO component to your main camera, for Universal Render Pipeline please refer to **section 10**, for High Definition Render Pipeline please refer to **section 11**.
For this you can drag the HBAO.cs script on your camera or select it from the Add Component menu (Image Effects/HBAO).

Important notice: the placement of the HBAO component in your post FX stack is really important! It should theoretically be the first effect in the chain meaning it should be placed on top.

In most scenarios, using **medium quality** with a **medium blur** and a radius near to 1 will yield very good results, this is what the normal preset uses.

You can use the presets as a starting point for your tweaks, but depending if you are targetting high performances vs beautiful AO you can use the following custom settings:
- high performances: low quality with wide blur, small radius,
- normal: medium quality with medium blur, medium radius,
- fine ao: high quality with narrow blur, large radius.

For even more performances you can use half resolution AO, but it generally introduces some objectionable flickering when the camera is in movement (and especially with fine geometry like foliage). In this case, enabling temporal filtering will help to stabilize the effect.

Using color bleeding can be heavier on performances as it requires an additional color sampling. The normal color bleeding saturation to use is 1.

Please note that you will see the AO effect in scene view and that HBAO component (or RendererFeature for URP) can be stacked.

4. Presets

The presets are here to help you as a guide on how to reach a specific level of quality or performance but once it is applied you can fine tune the settings as you please.

To apply a preset, first select it then click the Apply Preset button.

5. General settings

Pipeline Stage: 3 injection stages are available, in forward rendering, you have no other choice than "Before Image Effect Opaque", this is expected as the 2 other stages are for the deferred rendering pipeline. In Deferred you can choose any stage, but the better is "After Lighting" or "Before Reflections". With "Before Reflections" you'll get fully PBR lit AO which is great for realism whereas with "After Lighting" the AO won't be lit.

Reference:
http://docs.unity3d.com/Manual/GraphicsCommandBuffers.html

Quality (Lowest/Low/Medium/High/Highest): the quality used for the AO calculation. Higher the quality is, more sampling it requires and higher is the impact on perfomances.

Deinterleaving (Disabled/4x): new technology introduced in update 1.5. To get a real benefit from this setting, you need to use quite high resolutions. Deinterleaving is better used with resolutions ranging from HD to UltraHD.

Resolution (Full/Half): the resolution at which AO calculation should be performed. Not available when deinterleaving is enabled.
Note: can introduce some objectionable flickering when the camera is in movement (and especially with fine geometry like foliage).

Noise Type (Dither/Interleaved Gradient Noise/Spatial Distribution): 3 samples distribution modes are available.

Debug Mode: various debug modes are available to AO only or view normals displayed on screen.

6. AO settings

Radius: the AO calculation radius in world units.

Max Radius Pixels: the maximum AO radius in pixels, this can be used to limit how much the radius can grow for close objects.

Note: this can help to reduce the performance drop from close up views but keep in minds that it's a nonsense to get very low max radius pixels with large radiuses.

Bias: low tessellation geometry tends to make occlusion variations appear at creases and ridges, which betray the underlying tessellation. To remove these artifacts, the algorithm uses an angle bias which restricts the hemisphere.

Intensity: this value allow you to control how much the AO intensity is.

Use Multi Bounce / Multi Bounce Influence: enable multibounce AO approximation, with the influence setting you can adjust how much it is contributing to final result.

Offscreen Samples Contribution: how much offscreen samples are contributing to AO, this helps to stabilize AO on screen borders. A value of 0.2 seems optimal, may have a slight performance impact.

Max Distance: the max distance in world units at which AO can be drawn. You can use it to avoid occlusion at far distances and you should be careful to set this value lower to your camera far clipping plane to not waste performances.

Distance Falloff: the falloff distance of occlusion in world units. This prevents AO to appear cut in the max distance.

Per Pixel Normals (GBuffer/Camera/Reconstruct): generally GBuffer normals are preferable over Camera normals as it gives more precision, and hence less wobbles in movement. Reconstruct mode is heavier on performance since it is calculated from depth, however you may find it's preferable to take this perf hit instead of the overhead of the scene being redrawn in Forward rendering.

Note: GBuffer mode is only available for Deferred shading.

Base Color: allow you to tint the AO, the alpha channel being unused.

7. Temporal filter settings

Enabled: should temporal filtering be used.

Variance Clipping (Disabled/4Tap/8Tap): type of variance clipping to use in order to reduce ghosting even more.

8. Blur settings

Type (None/Narrow/Medium/Wide/Extra Wide): this lets you control how much to blur the occlusion.

Sharpness: sharpens AO around depth discontinuities. This is preferable to use the maximum value to get a clean sharpened blur.

9. Color bleeding settings

Enabled: should color bleeding be used. Please remember that using color bleeding is heavier on performances as it requires an additional color sampling.

Saturation: controls the saturation of the color bleeding. The normal saturation to use is 1.

Albedo multiplier (available in After Lighting and Before Reflections pipeline stages only): this value scales the albedo contribution of the color bleeding samples.

Brightness Mask / Brightness Mask Range: helps to control how much emission from source contributes to color bleeding. It will allow to cut off too bright colors from lights for example.

10. Universal Render Pipeline

HBAO fully supports but the required content is packaged inside SRP folder, you will need to unpack it into your project by double clicking it.

Once done, browse to your pipeline renderer asset in your project window, select it and in inspector add a HBAO Renderer Feature to your renderer by clicking the plus icon:
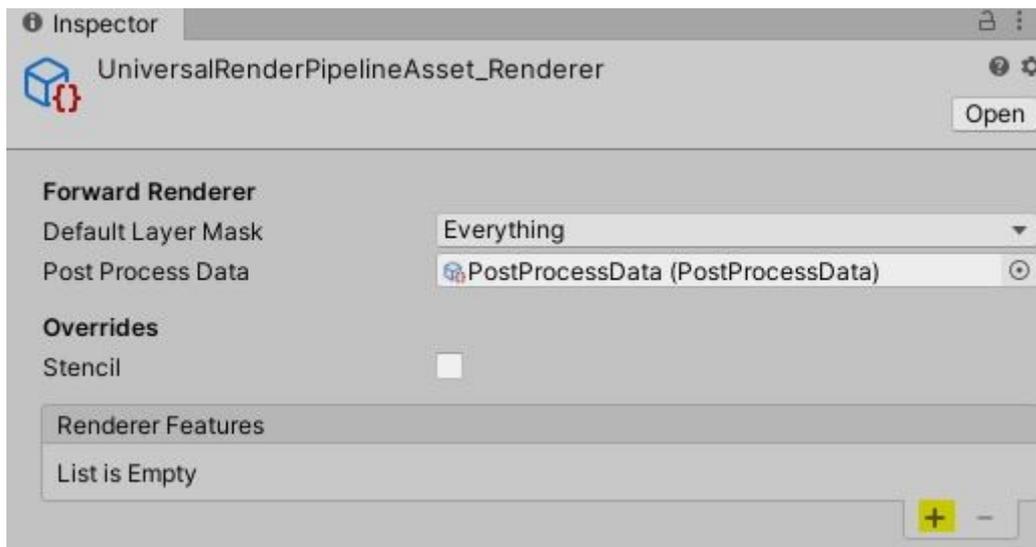
The HBAO Renderer Feature is added to the list:
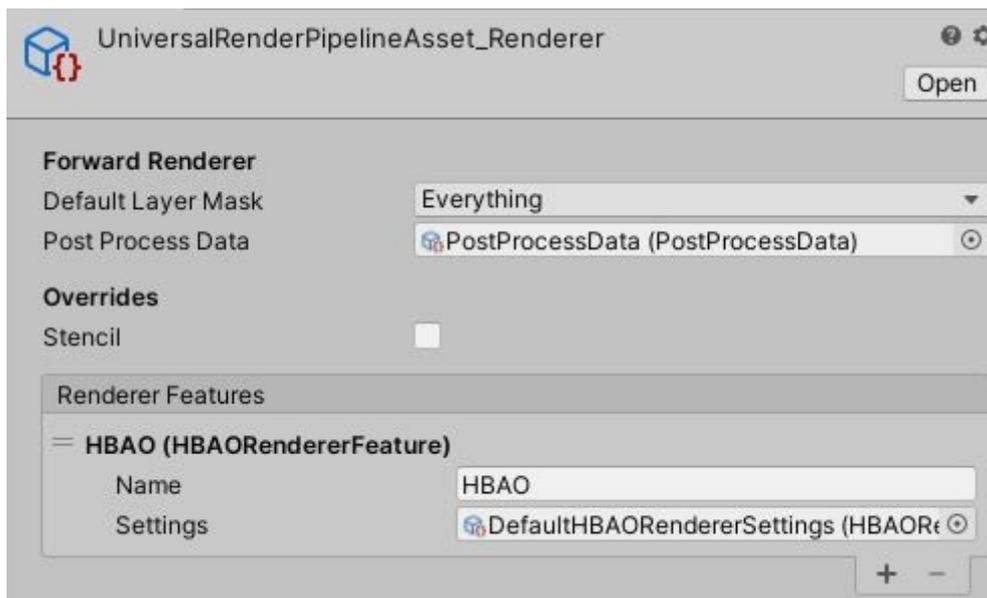
HBAO require rendering a depth texture in order to work, select you pipeline asset in the project window, and in inspector make sure depth texture is enabled (you can enable it too directly on a camera):
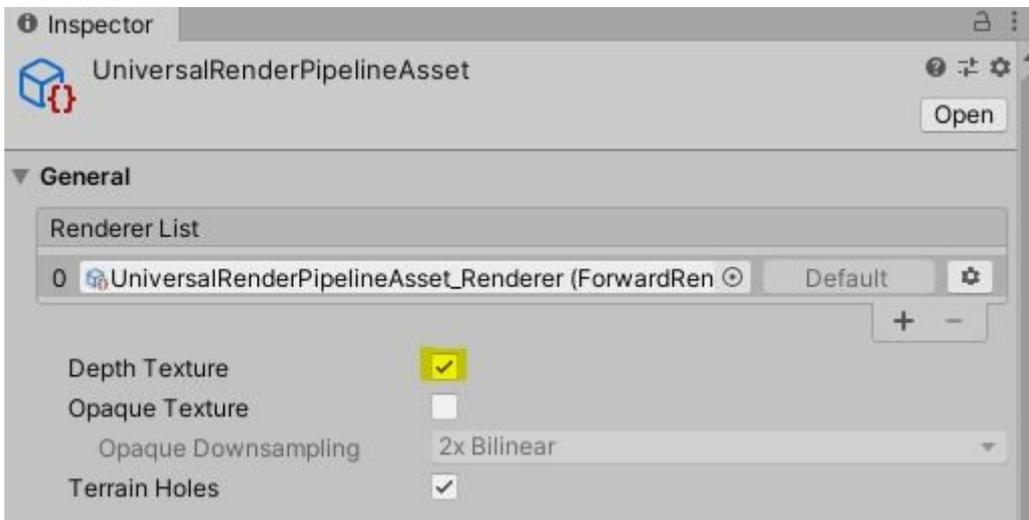
Once this setup is done, HBAO is already active in all your scenes like any Post Process effect would be, make sure you enable Post Processing on your cameras that should render HBAO:
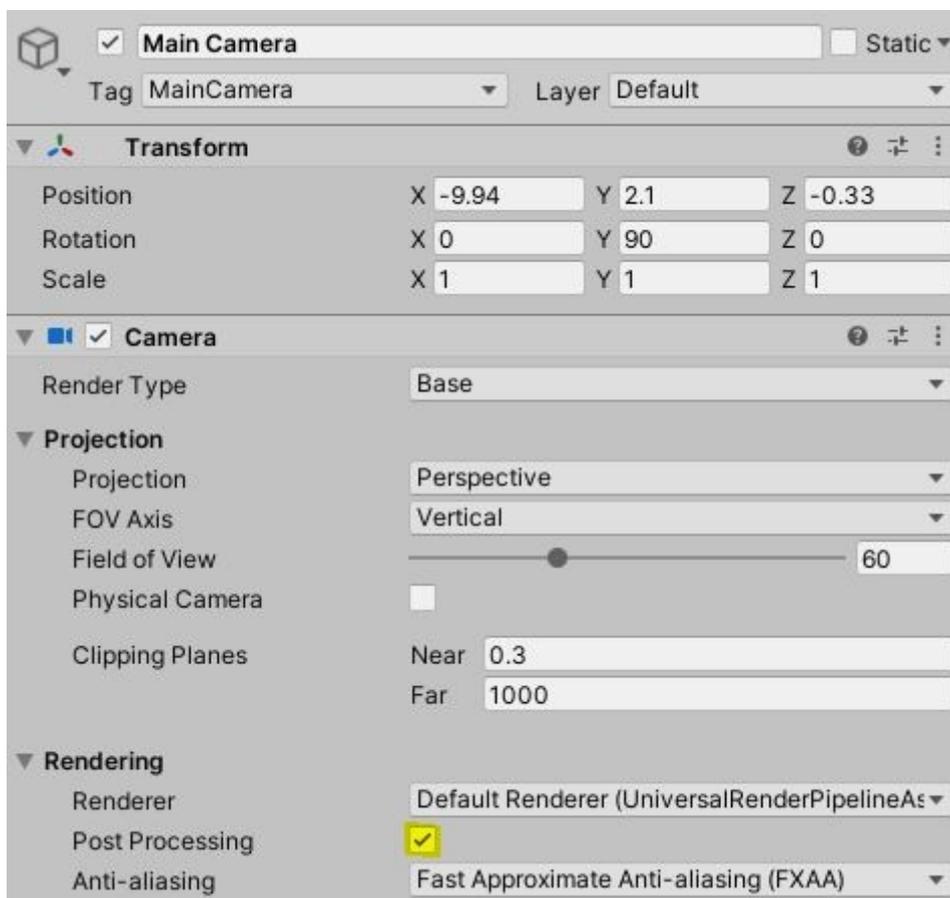
Finally, you can then add a component override to your volume profiles:

11. High Definition Render Pipeline

HBAO fully supports HDRP but the required content is packaged inside SRP folder, you will need to unpack it into your project by double clicking it.

Once done, browse to your HDRP Default Settings and at the bottom there's a Custom Post Process Orders, in After Opaque And Sky list, click the plus sign then add the HBAO custom post process:
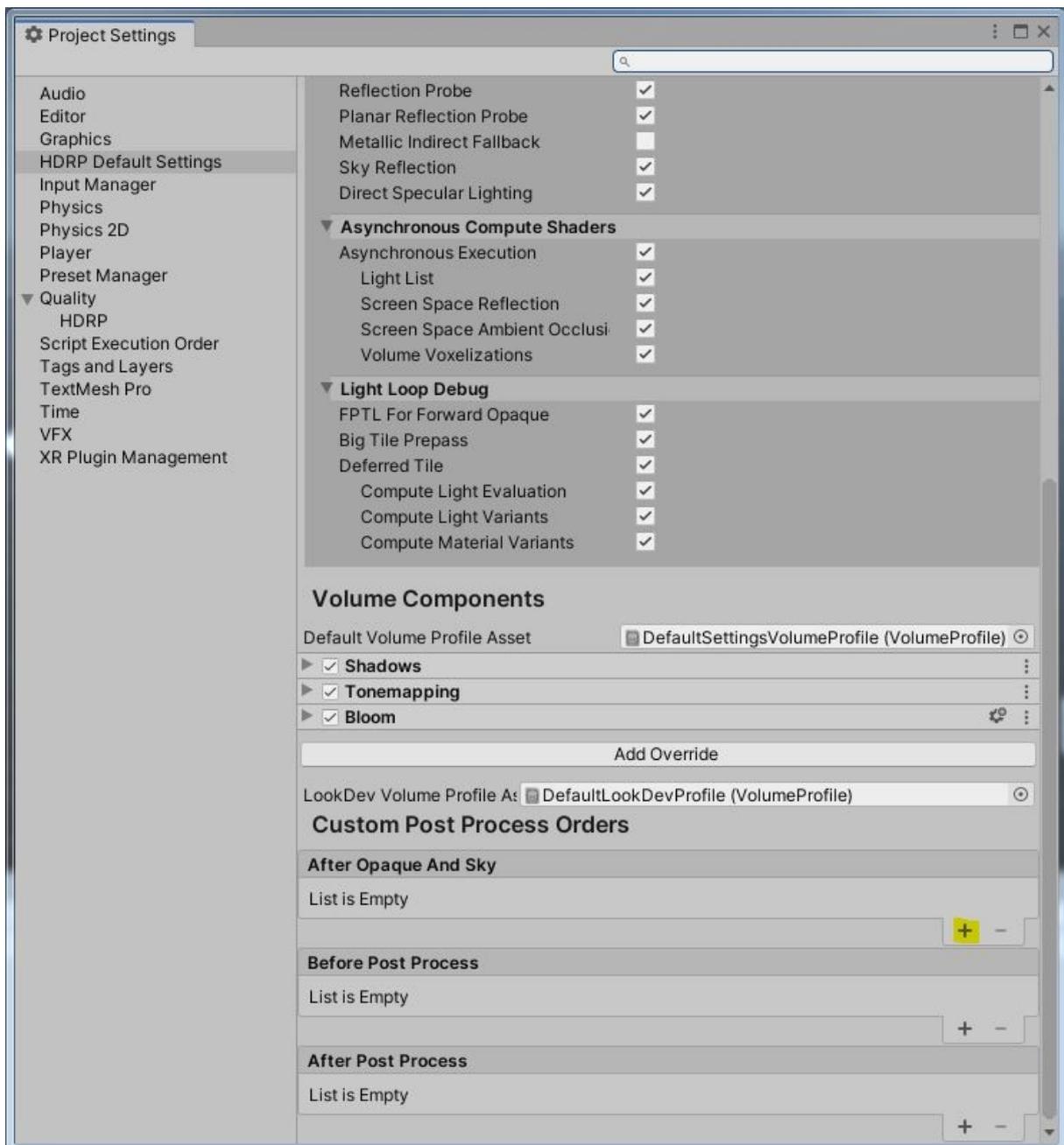
When added it should look like this:
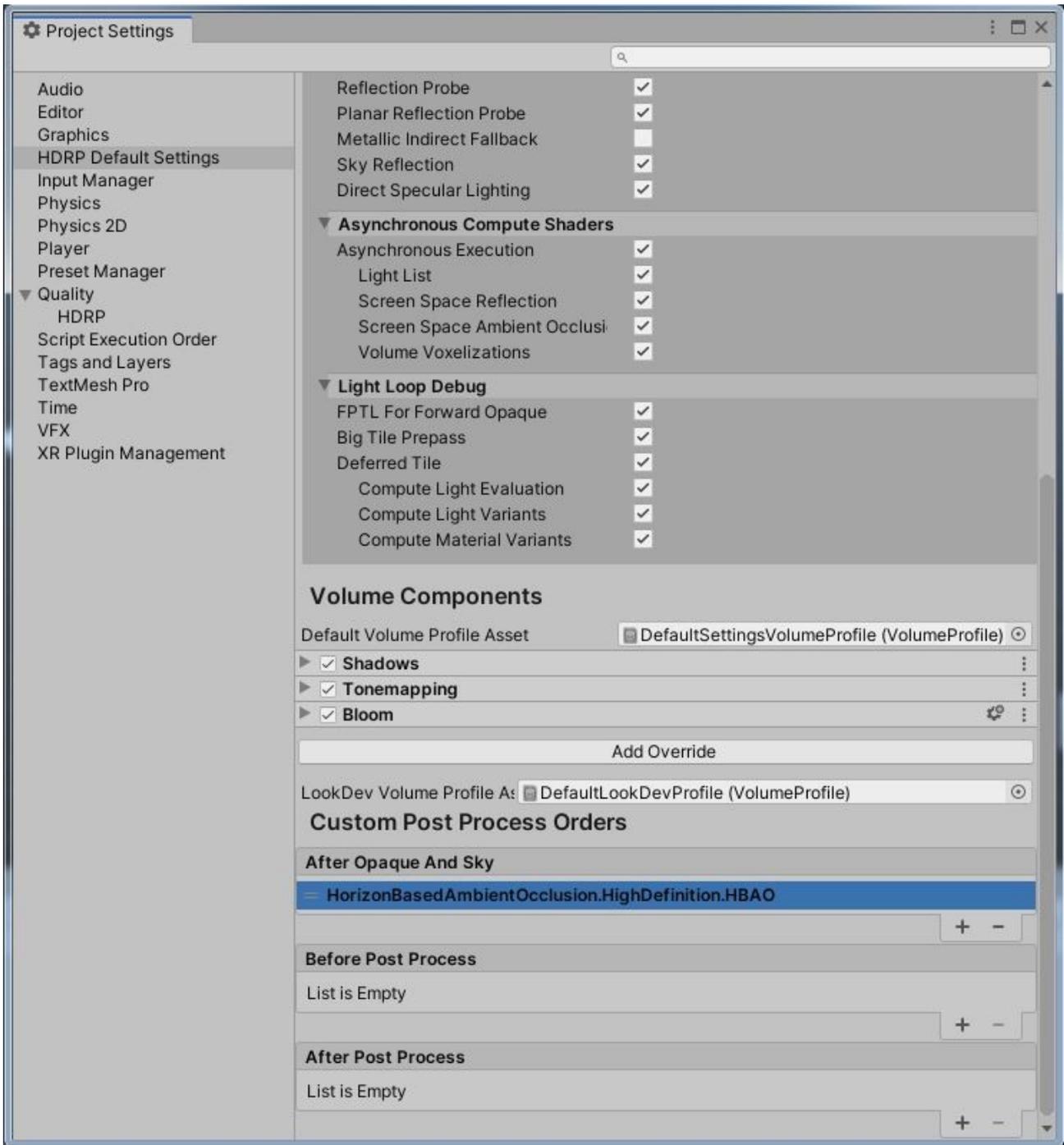
After that, HBAO is effective in your project, but one thing you should keep in mind is that Unity already runs a Screen Space Ambient Occlusion effect that you should normally disable. This can be done either in your pipeline asset settings, in HDRP default settings too or on a camera with custom frame settings.

If you're disabling Unity's SSAO from HDRP Default Settings, it's under Frame Settings for the camera, in the Lighting properties:
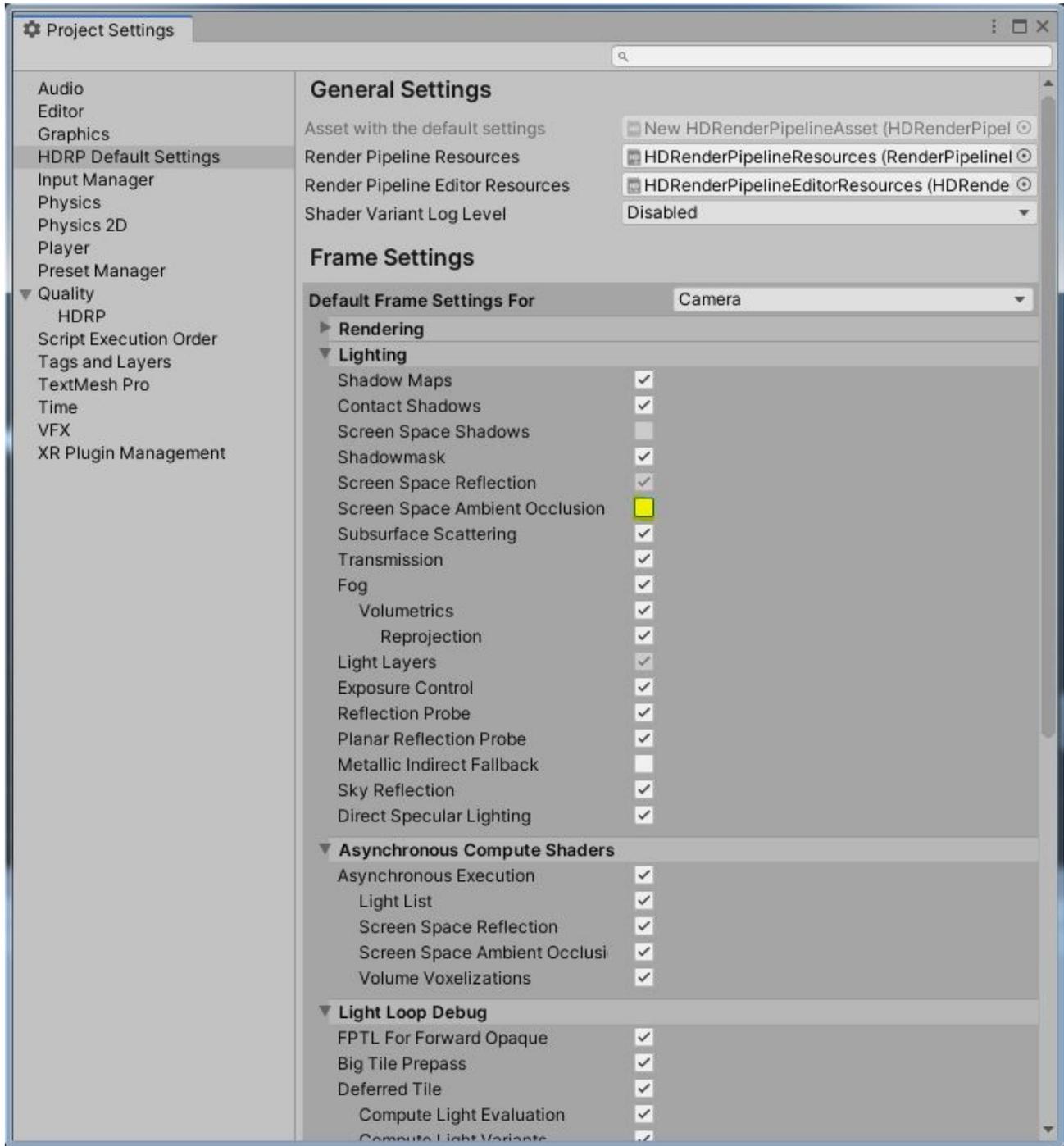
Once this setup is done, HBAO is already active in all your scenes like any Post Process effect would be, you can then add a component override to your volume profiles:

12. Support

In case you need help, you can use the foum thread:
http://forum.unity3d.com/threads/horizon-based-ambient-occlusion-hbao-image-effect.387374/

For any support request, please drop me an email at
jimmikaelkael@gmail.com