CHAPTER 1: WORLD SPACE

CREATING A NEW WORLD SPACE

Important: Before you begin, if you plan on starting with a height-map generated by a third-party program such as World Machine, refer to the Creating a height-map with World Machine section instead.

This section will focus on creating a brand new world space **manually** in the Creation Kit. Typically this is the first thing you're going to want to do when starting on a new lands mod.

A world space is basically our overworld map. Unlike an interior cell, a world space is divided into cells to allow the game engine to load and unload assets based on the player's proximity to them.

Launch the Creation Kit. Go to File > Data, tick Skyrim.esm, click OK and let it load.

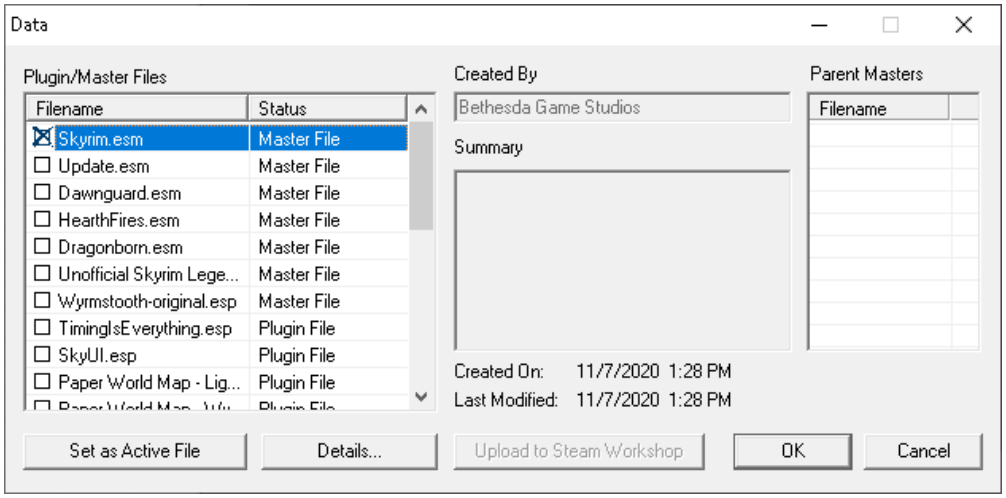

Figure 7 - Plugin/Master file loader.

Go to World > World Spaces.

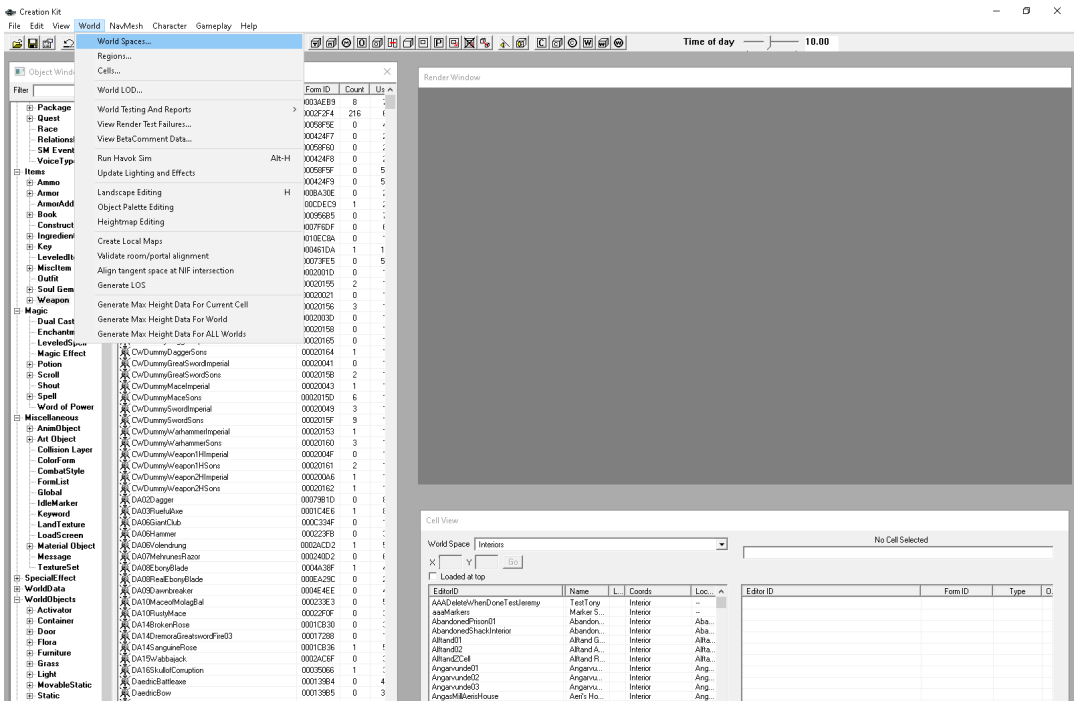

Figure 8 - World menu.

Right-click in the empty space beneath the list of world spaces and select New.

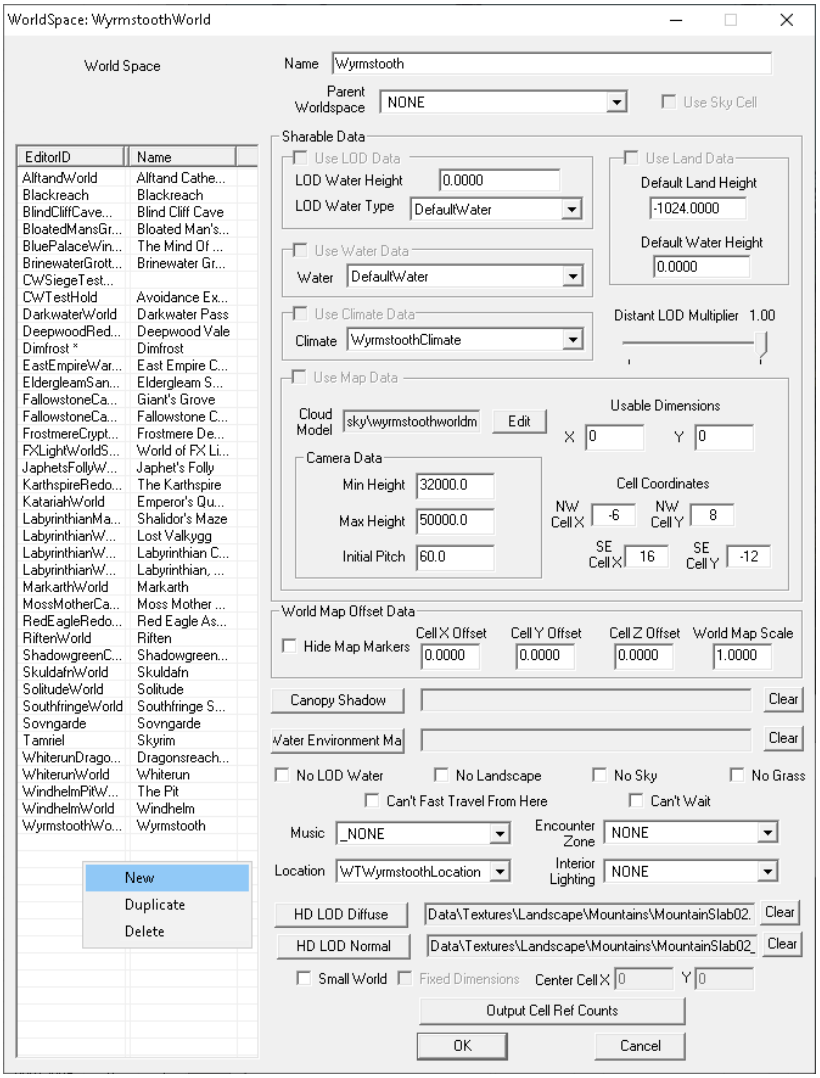

Figure 9 - World Spaces.

Enter a form ID for your new world space and click OK.

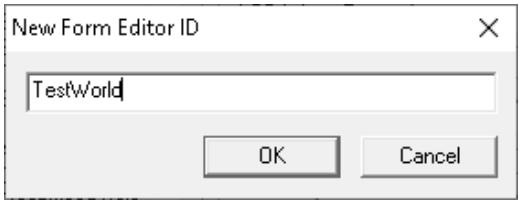

Figure 10 - World Space form ID.

Select your new world space in the list and give it a name.

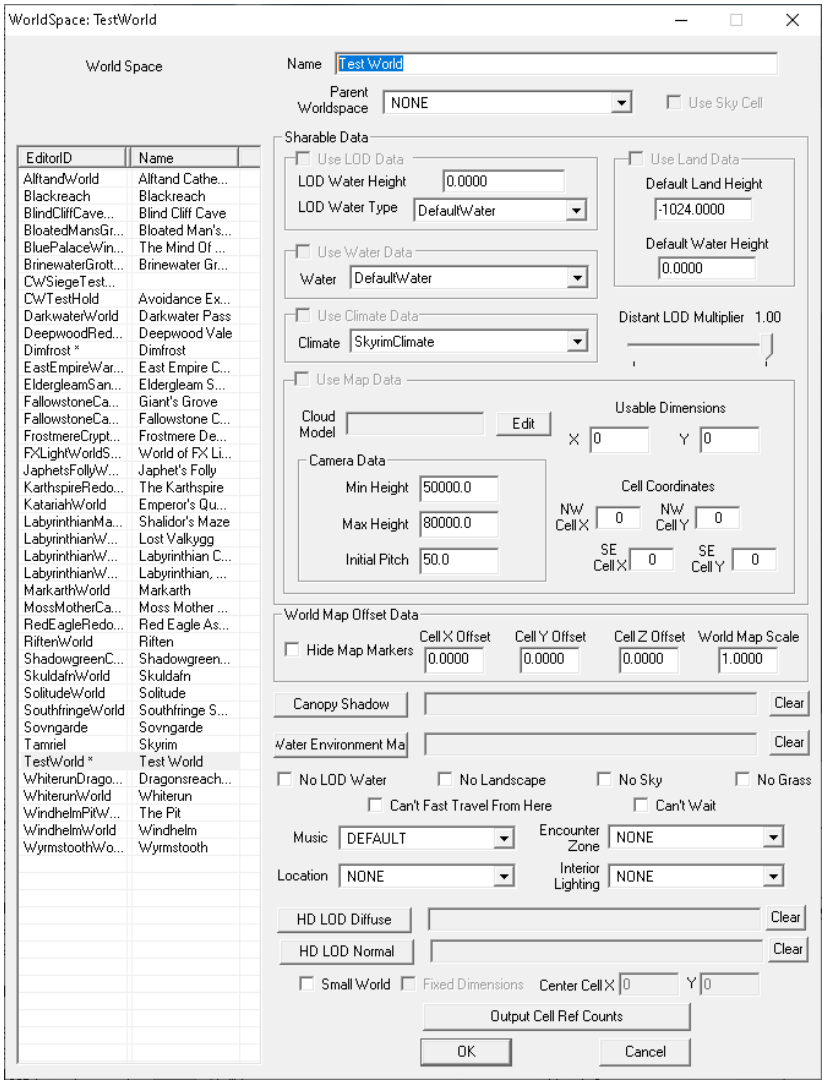

Figure 11 - World Space details.

For now let's just set the Climate to SkyrimClimate, set the Default Land Height to -1024 and untick Small World. Everything else can be left at its default values for now.

Click OK to close.

In the Cell View, change the current world space to the world space you just created. You should see a single Wilderness cell at the coordinates '0,0'. Double-clicking on this cell will load the new world space at that cell and will automatically generate cells around it.

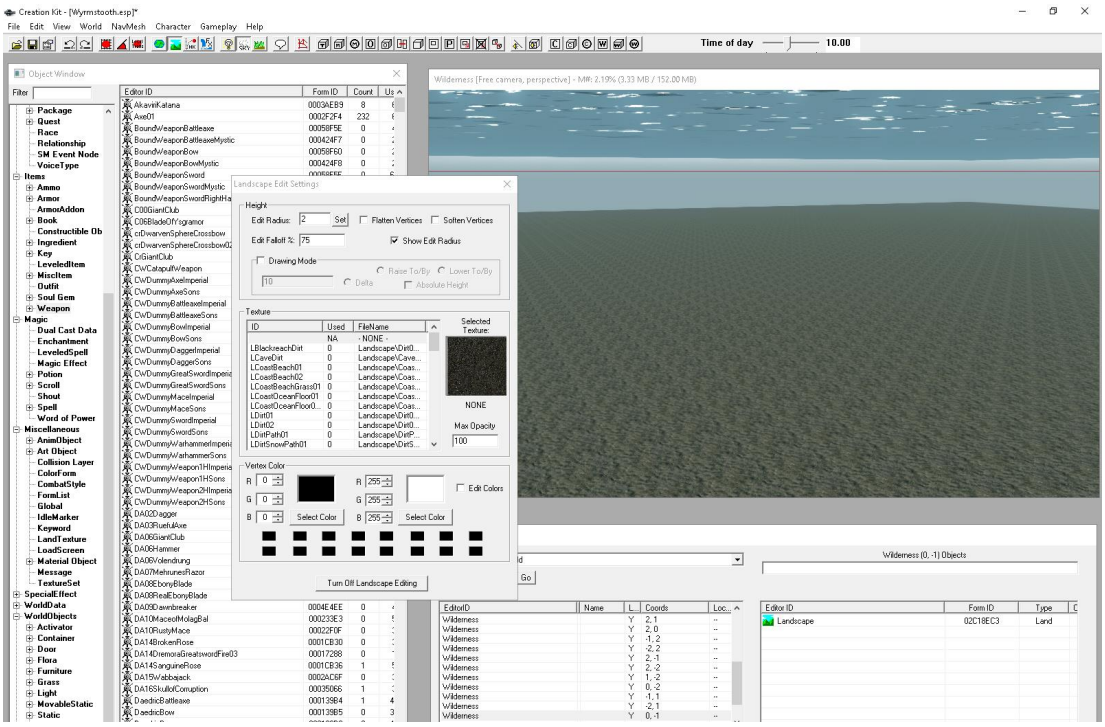

Figure 12 - The new world space.

Right now everything will be underwater. You can use the 'H' hotkey to bring up the Landscape Editing tool. With the tool active, you can rotate the camera around by holding down the Shift key while moving the mouse to get a better view. Hold down the Spacebar while moving your mouse or hold down the middle mouse button to pan around.

CREATING A HEIGHT-MAP USING WORLD MACHINE

In this section I'll be covering the process of generating a height map in World Machine that we can use to create a new world space for Skyrim.

You'll need a copy of World Machine which you can download from their website.

Install World Machine and launch it.

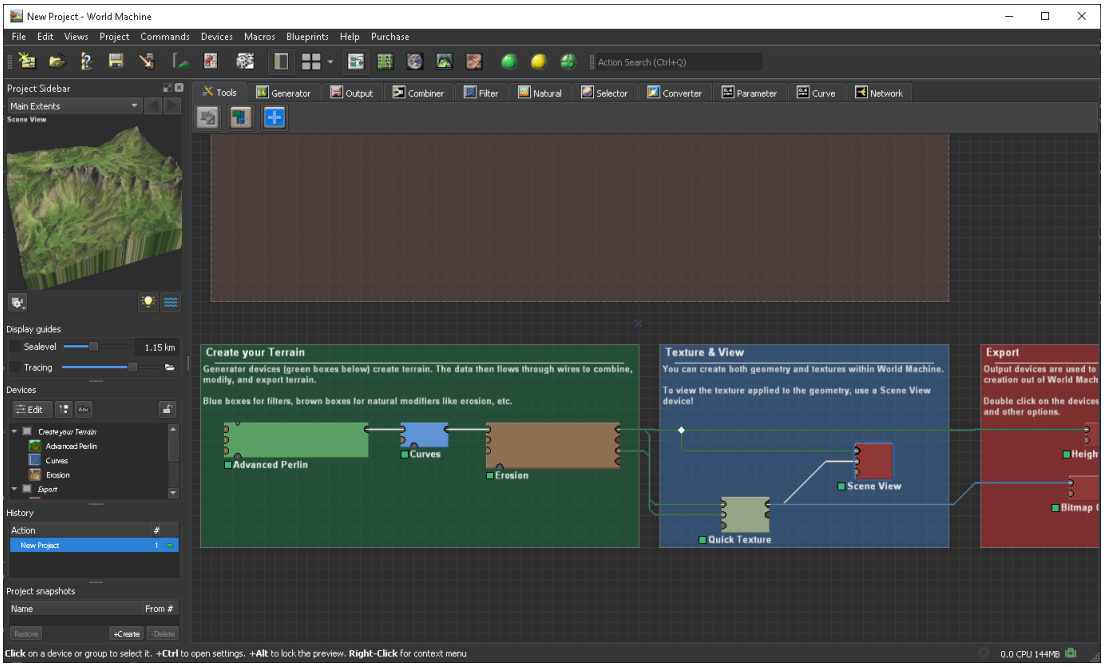

Figure 13 - The World Machine default project.

World Machine is a node-based height map generator. It can be used to create a height map from scratch and apply realistic erosion.

Note: this section won't be a deep dive into every facet of World Machine. I'm just going to cover the basic process of combining different nodes to generate a height map that we can export.

Later we'll be using TESAnnwyn to create a new .esp file using the height-map we create to shape our first world space.

I'm going to start by clearing out the existing nodes. Just click on everything and press Delete.

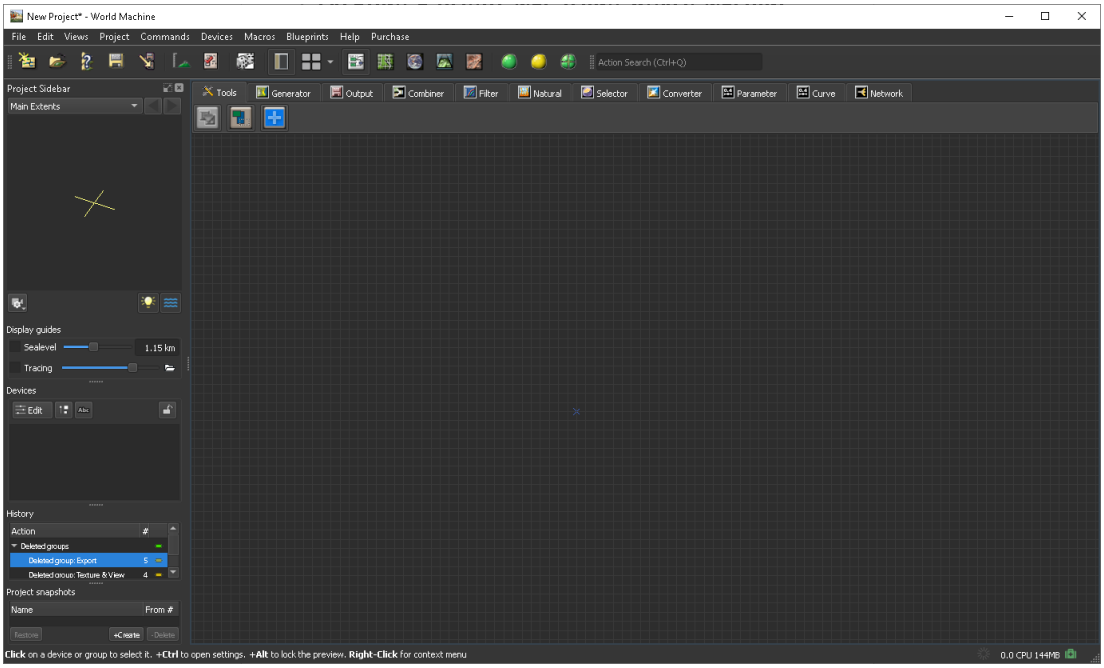

Figure 14 - Blank project.

So let's say we wanted to create an island world space. Go to the Generator tab, click on the Radial Grad button and click on the workspace to place the node.

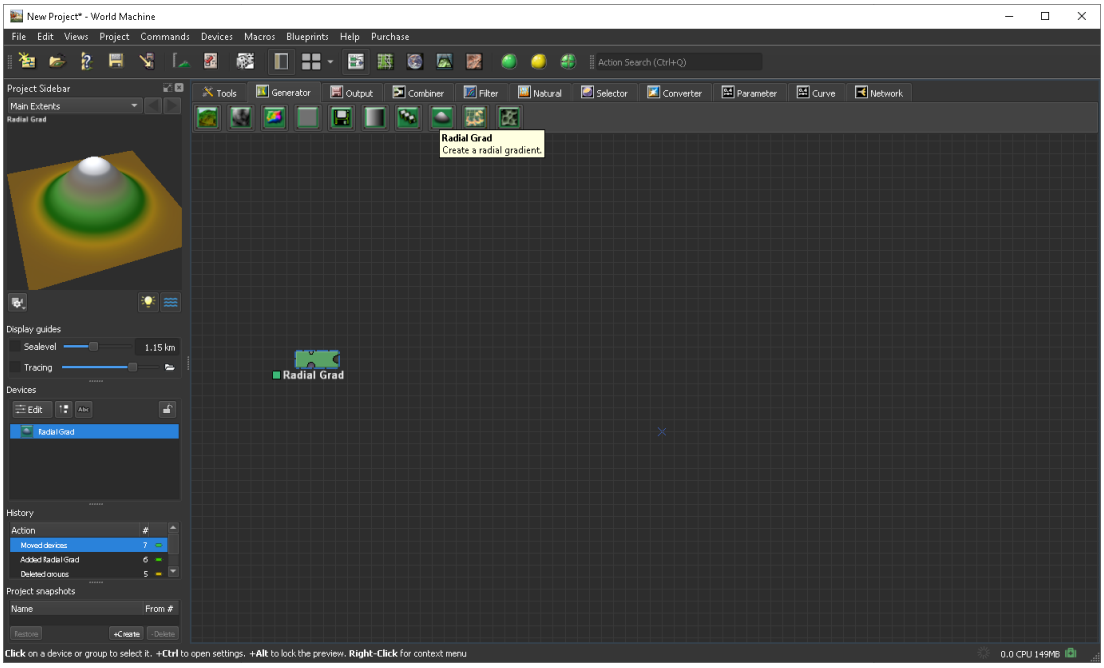

Figure 15 - Adding a Radial Grad node.

Near the top-left you can see a small preview of what our landscape looks like so far.

Double-click on the Radial Grad node to open its properties.

Reduce the radius to about 3.2 km then click Close.

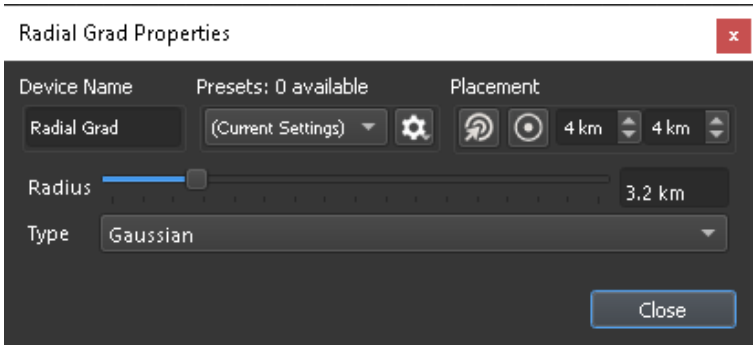

Figure 16 - Reducing Radial Grad radius.

Click on Advanced Perlin and place a node next to your Radial Grad node.

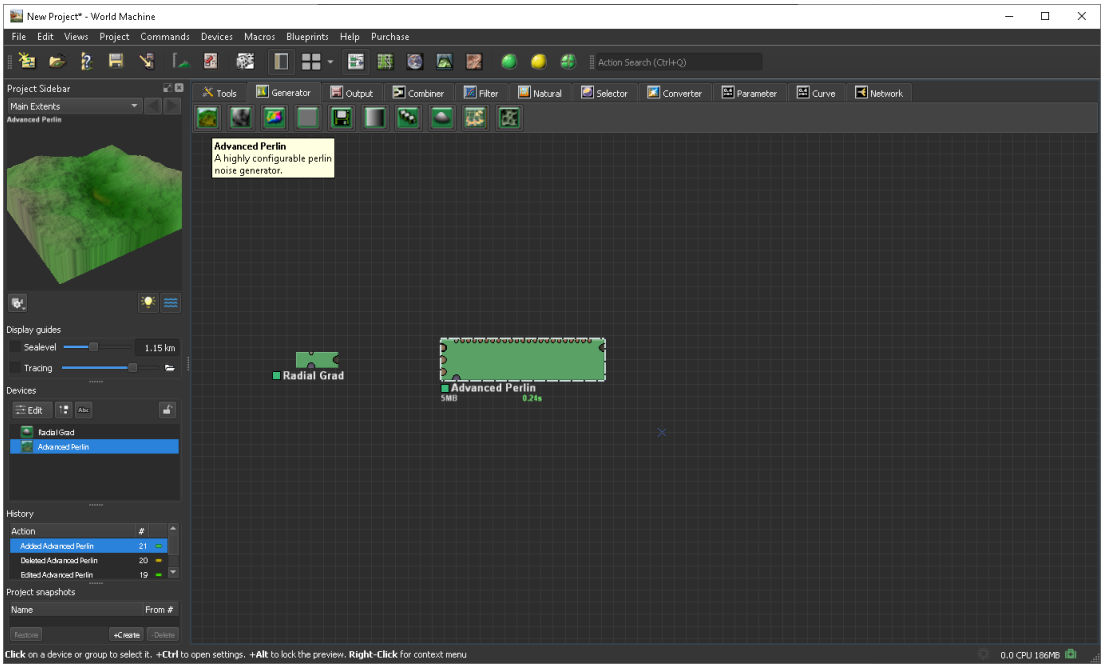

Figure 17 - Placing an Advanced Perlin node.

Connect the two nodes by clicking and dragging on the Radial Grad's primary output and link it to the Advanced Perlin's Shaping Guide input.

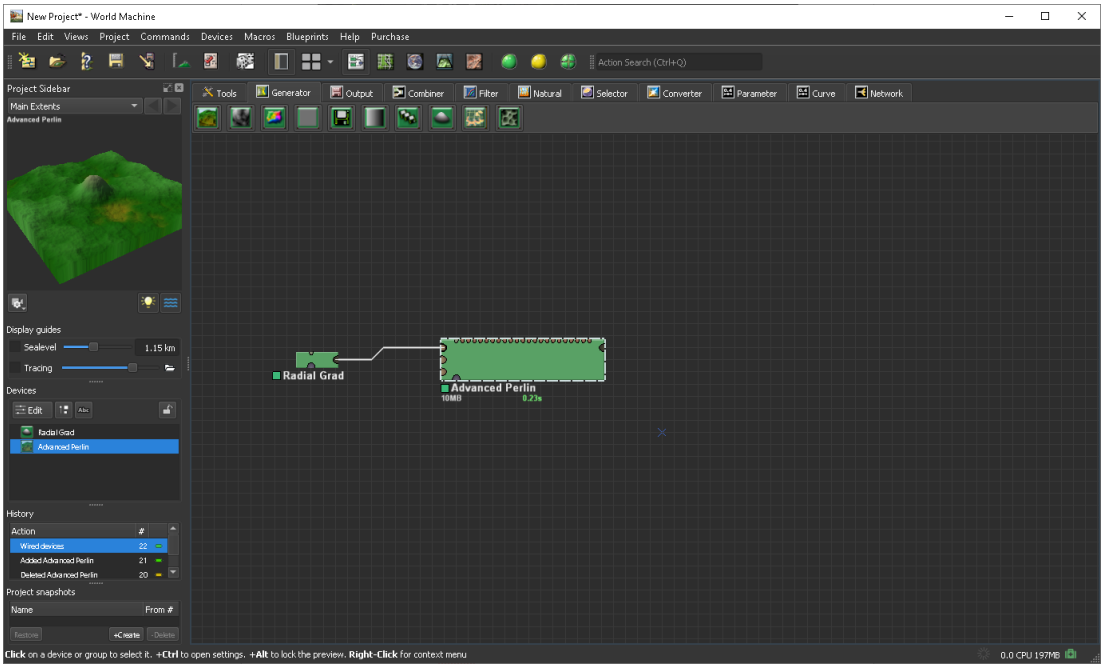

Figure 18 - Linking the Radial Grad to the Advanced Perlin.

In the preview you can see how both nodes are being combined.

Double-click on Advanced Perlin to open its properties.

For my example, I set the Feature Scale to 3 km, the Style to 'Smooth Billowy' and the Middle Elevation to 1 km.

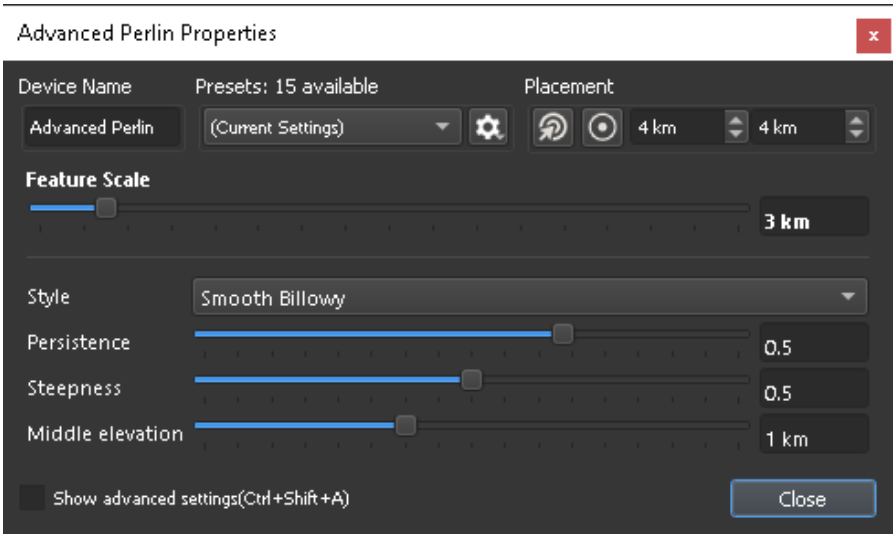

Figure 19 - Advanced Perlin properties.

Tick 'Show advanced settings'.

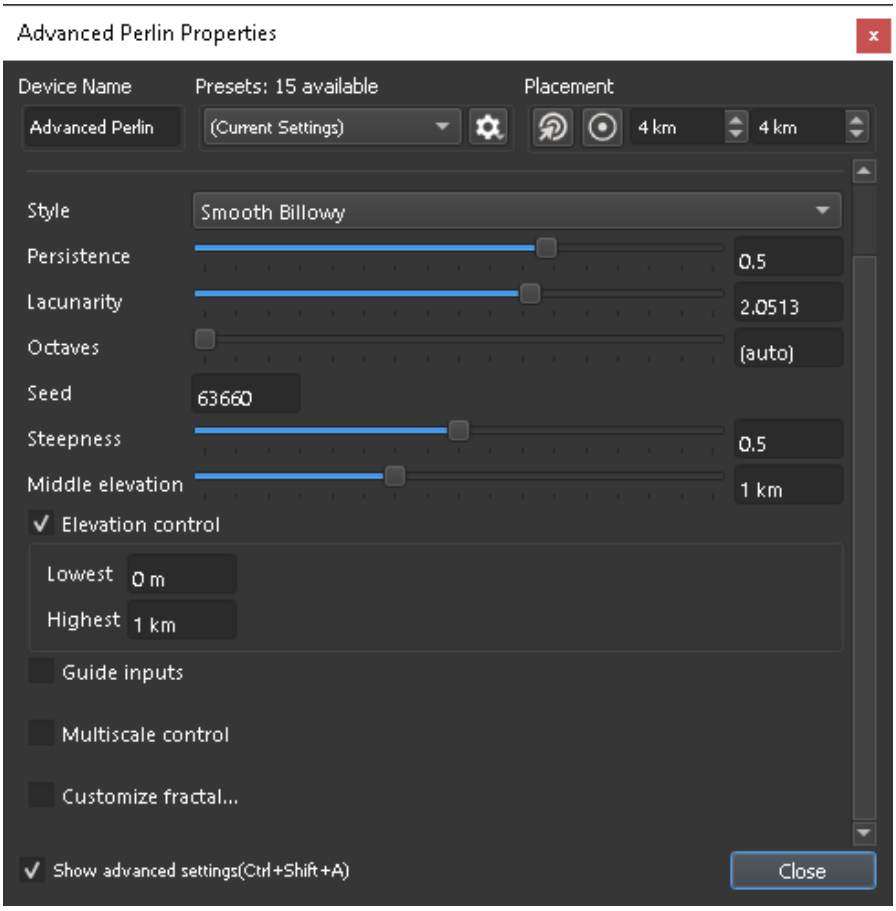

Figure 20 - Elevation control.

Tick 'Elevation control' and set the Highest field to 1 km.

Click Close.

Our central island mountain looks too conical, so let's try and break that shape up.

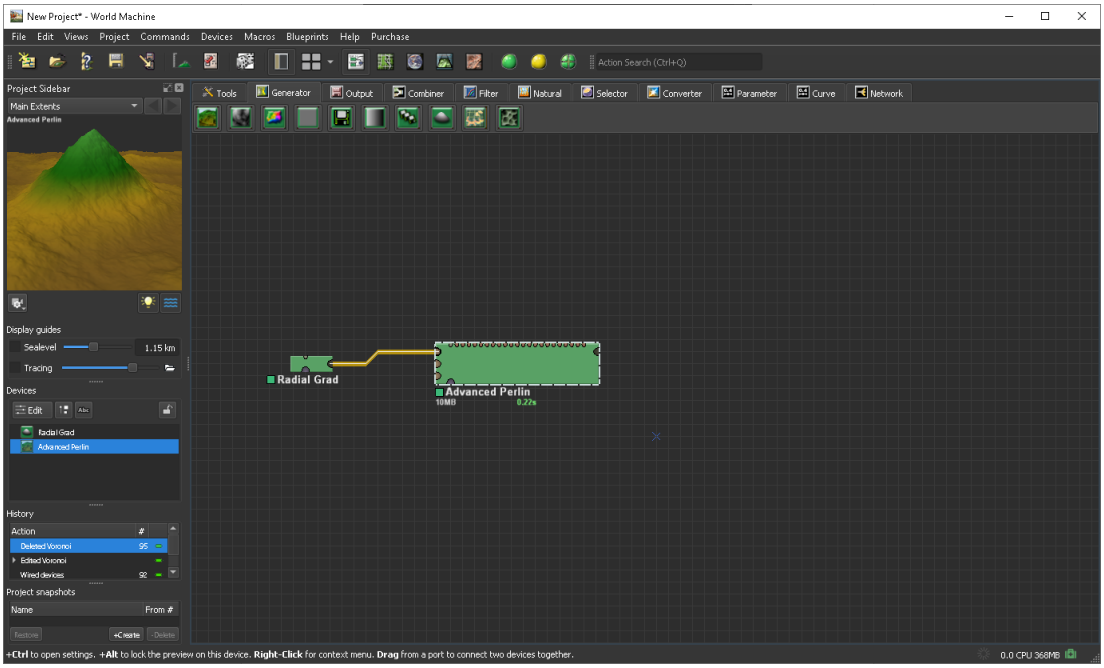

Figure 21 - Height-map preview.

Click on Voroni and place a node on your workspace.

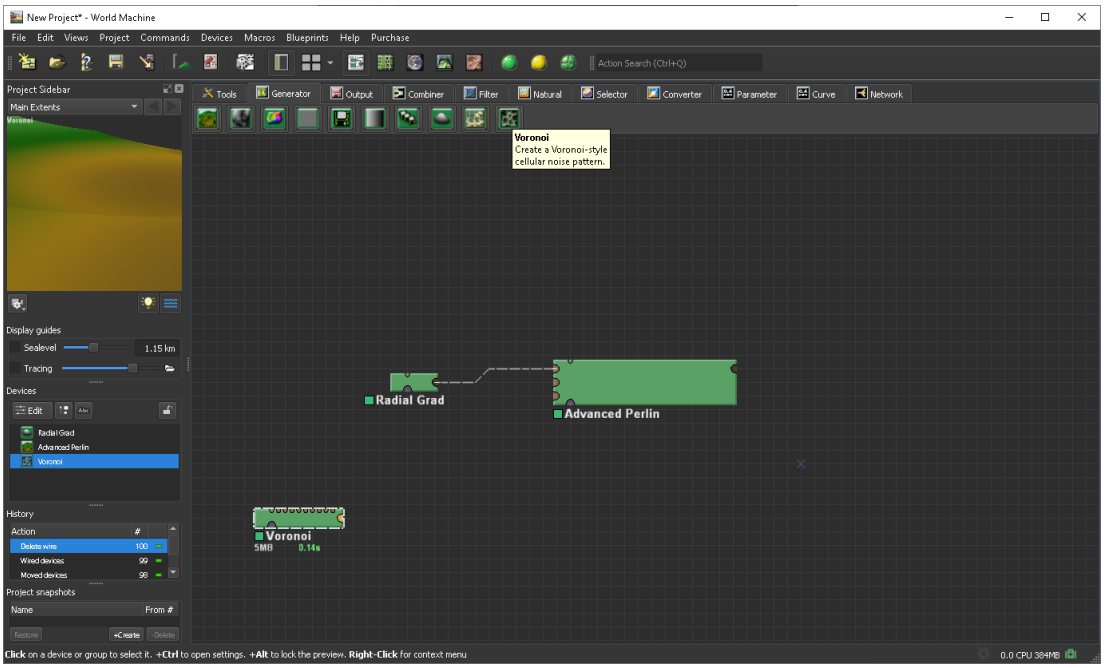

Figure 22 - Adding a voronoi node.

Double-click on the Voronoi node to open its properties.

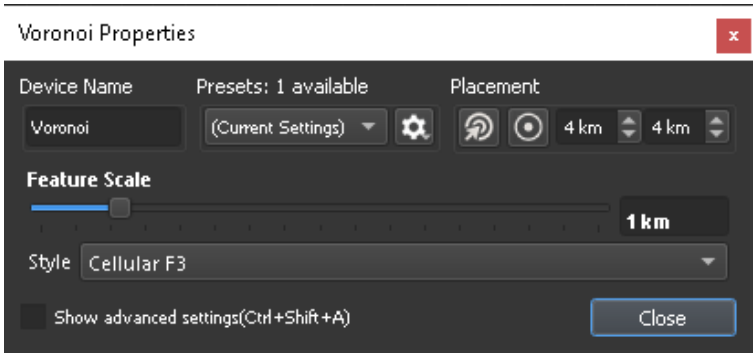

Figure 23 - Voronoi properties.

Set Feature Scale to 1 km and Style to 'Cellular F3'.

Click Close.

Connect the Voronoi node's primary output to the Radial Grad node's Mask Input.

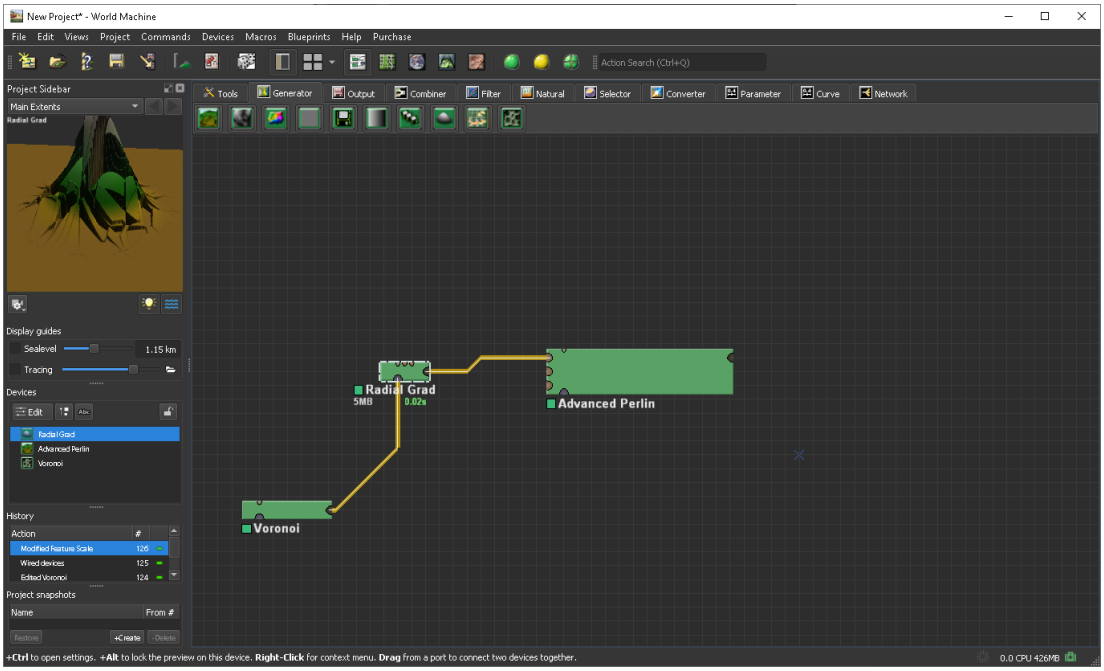

Figure 24 - Connecting the Voronoi node to the Radial Grad node.

This should help break up that cone shape.

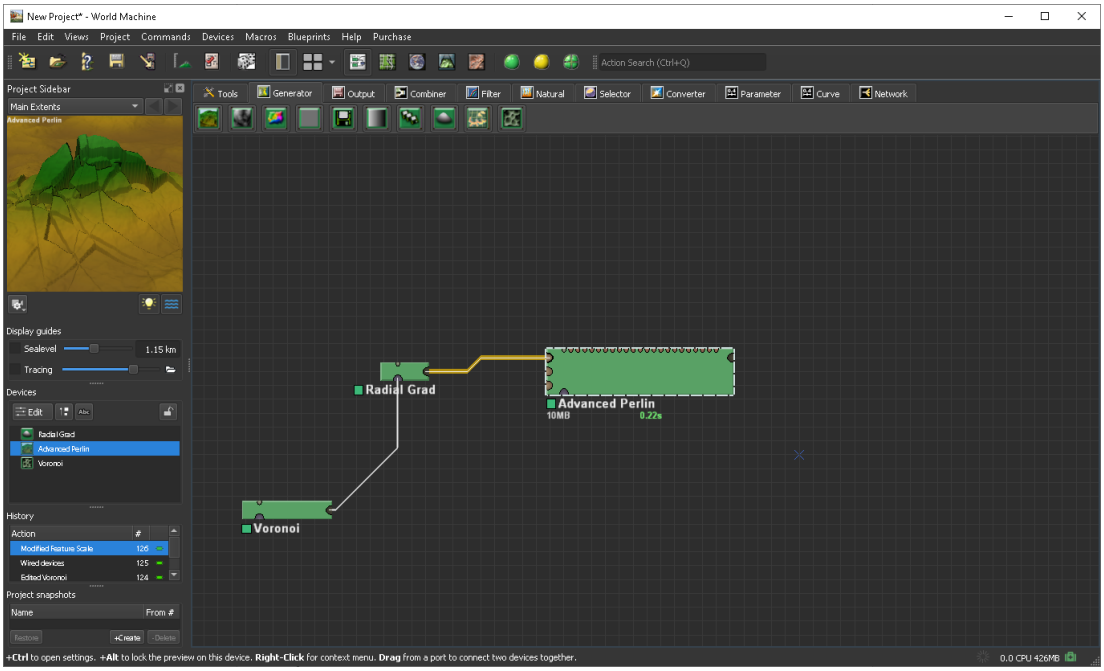

Figure 25 - Radial Grad with Voronoi.

We can further change the overall shape of the island by combining two inputs and passing the output to the Advanced Perlin node.

Right-click on the line between Radial Grad and Advanced Perlin and select 'Delete wire'.

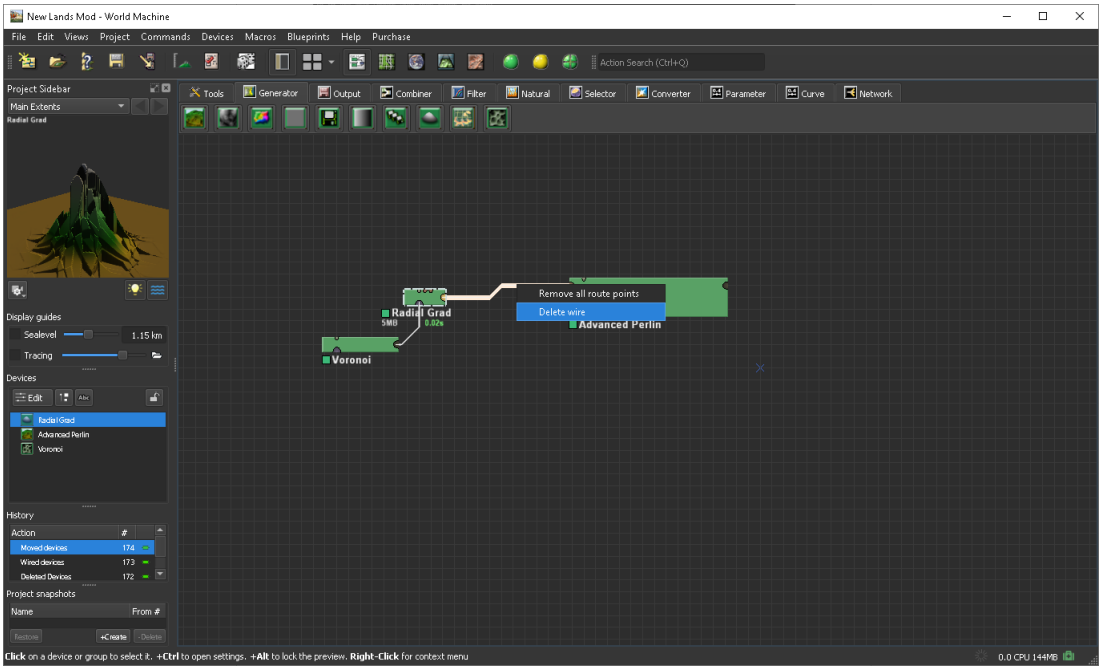

Figure 26 - Removing the link between Radial Grad and Advanced Perlin.

Go to the Combiner tab and select Combiner.

Click in your workspace to add it.

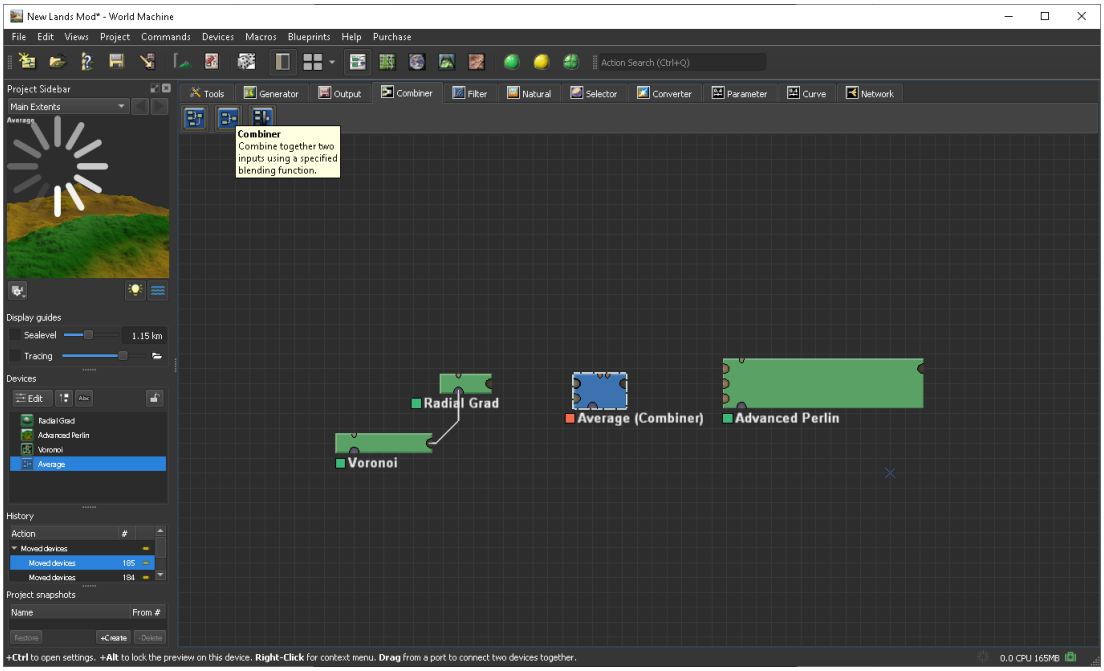

Figure 27 - Adding a combiner node.

Link the Radial Grad to the first input on the combine node, and link the combiner node's output to the Advanced Perlin node.

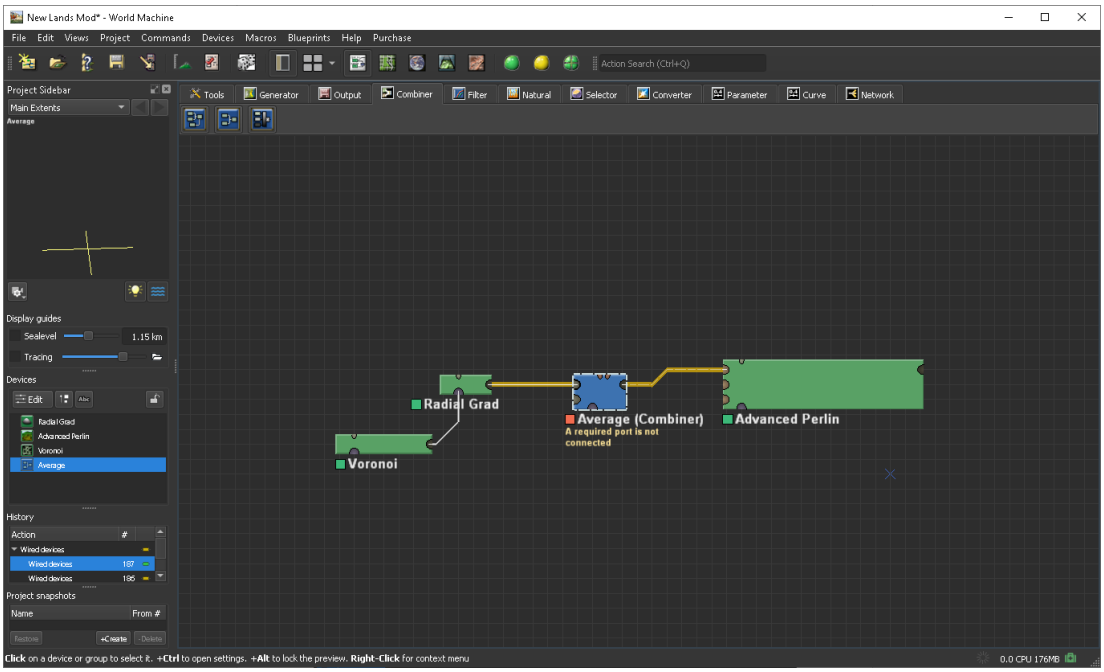

Figure 28 - Linking the first set of nodes to the combiner node.

Click on the Voronoi node to select it. Press CTRL+C to copy it and CTRL+V to place a copy of the node in your workspace.

Do the same for the Radial Grad node.

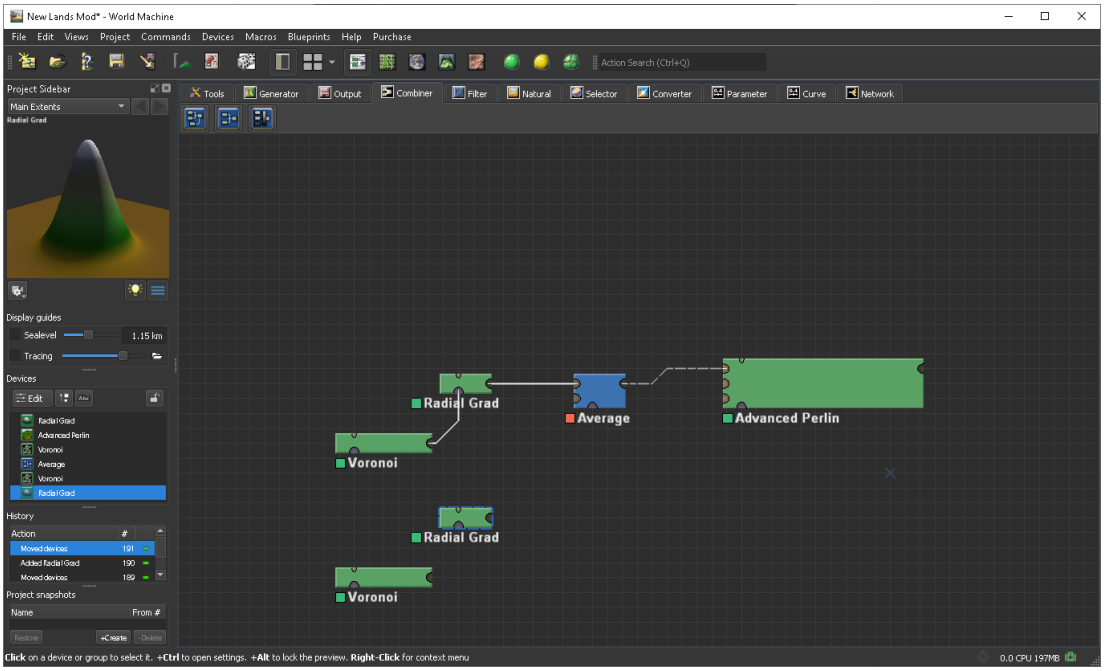

Figure 29 - Copied the Voronoi and Radial Grad nodes.

Link the Voronoi node to the Radial Grad node and link the Radial Grad node to the second input on the combiner node.

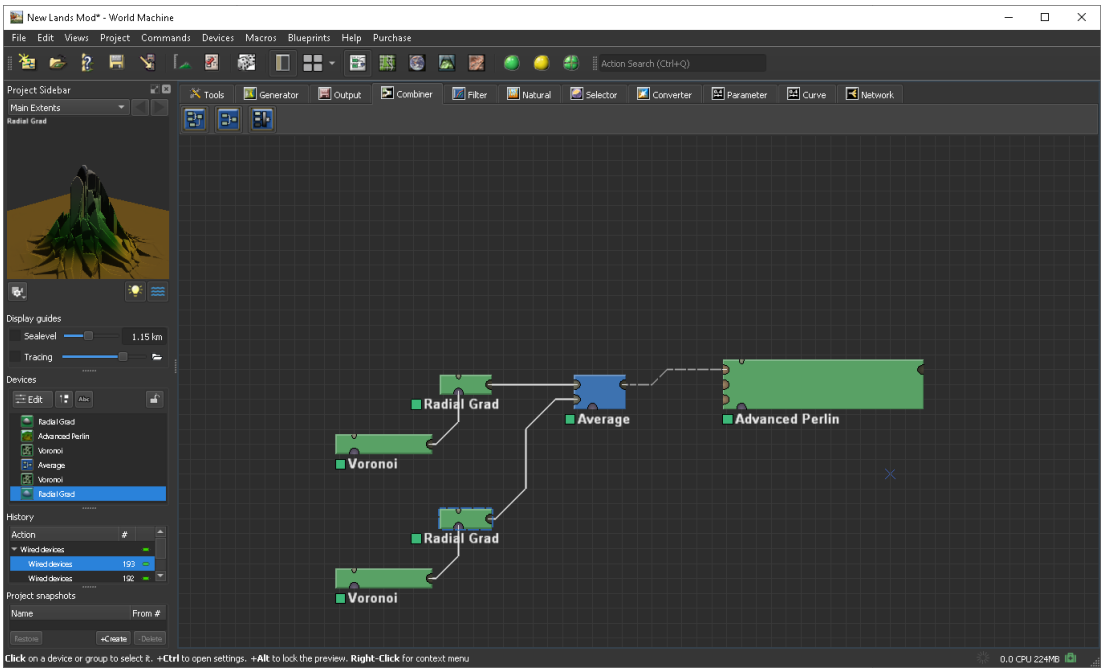

Figure 30 - Linking the second set of inputs to the combiner node.

Double-click on the second Radial Grad node to open its properties.

In my example, I offset its Placement to 3 km in both the X and Y fields.

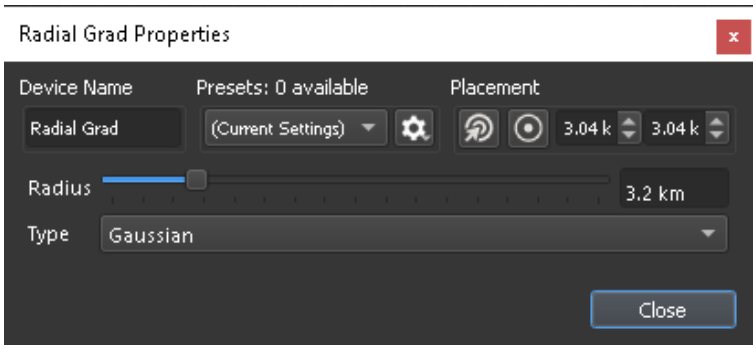

Figure 31 - Changing the Placement offset of the second Radial Grad node.

Click Close.

Now double-click on the combiner node to open it's properties.

Set the Method to Add and the Strength to 0.45.

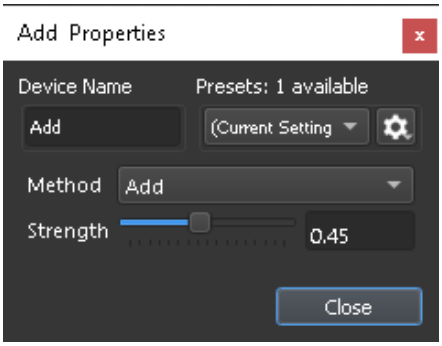

Figure 32 - Changing the combiner node's method and strength.

Click Close.

Alright, so let's change things up a bit more.

Delete the link between the combiner and the Advanced Perlin node.

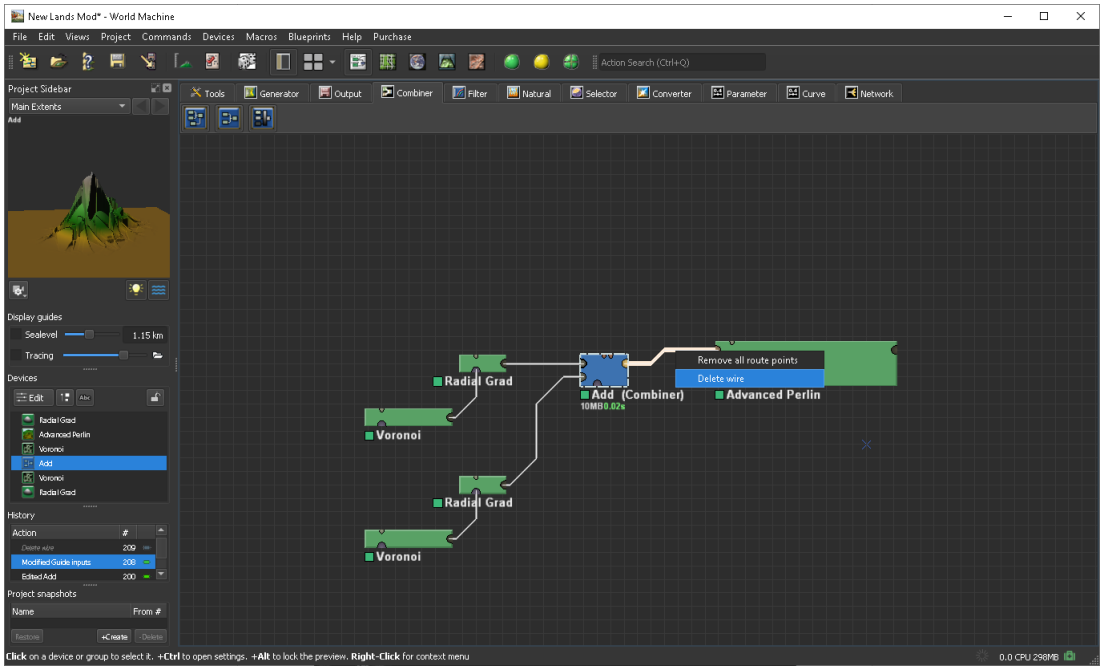

Figure 33 - Removing the link between the combiner node and the Advanced Perlin node.

Add another combiner node.

Connect the output from the Advanced Perlin node to the first input on the new combiner node, then add the output of the first combiner node to the second input on the new combiner node.

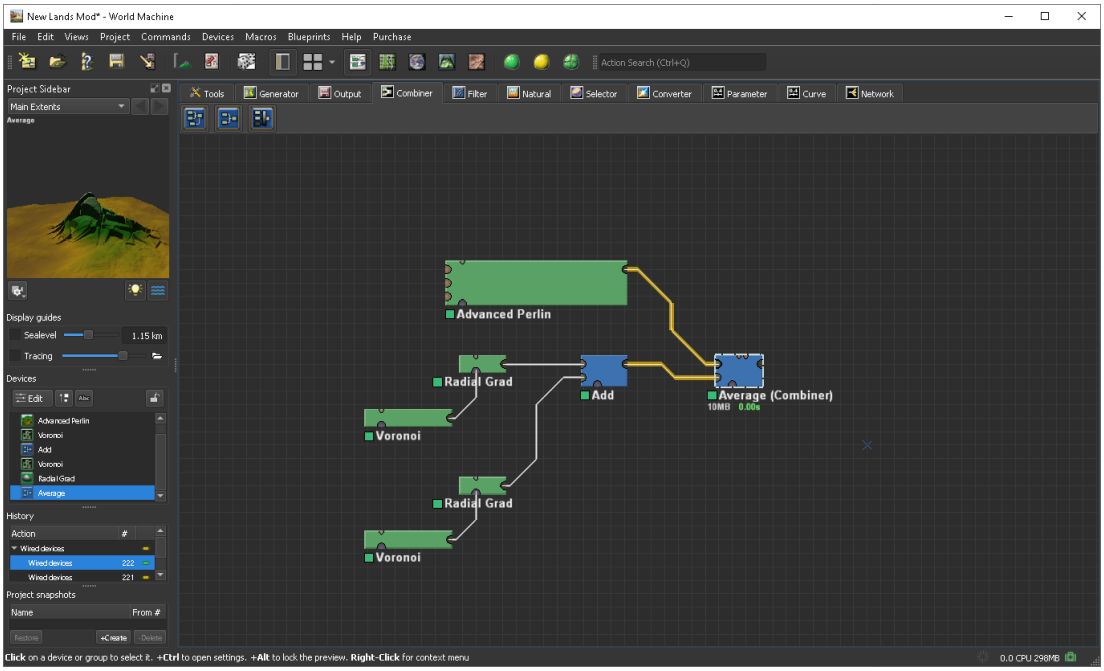

Figure 34 - Second combiner node.

Alright, now we have a less regular island shape. Click on the 3D View button to get a closer look.

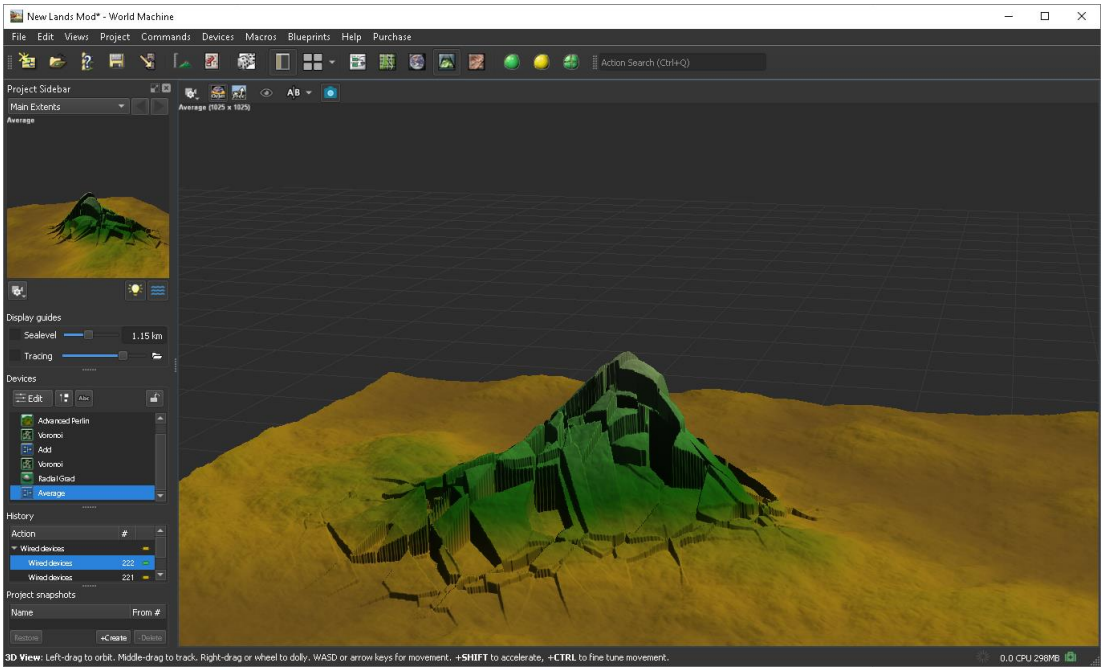

Figure 35 - Preview of our island so far.

Click on the Device Workflow button to return to the workspace.

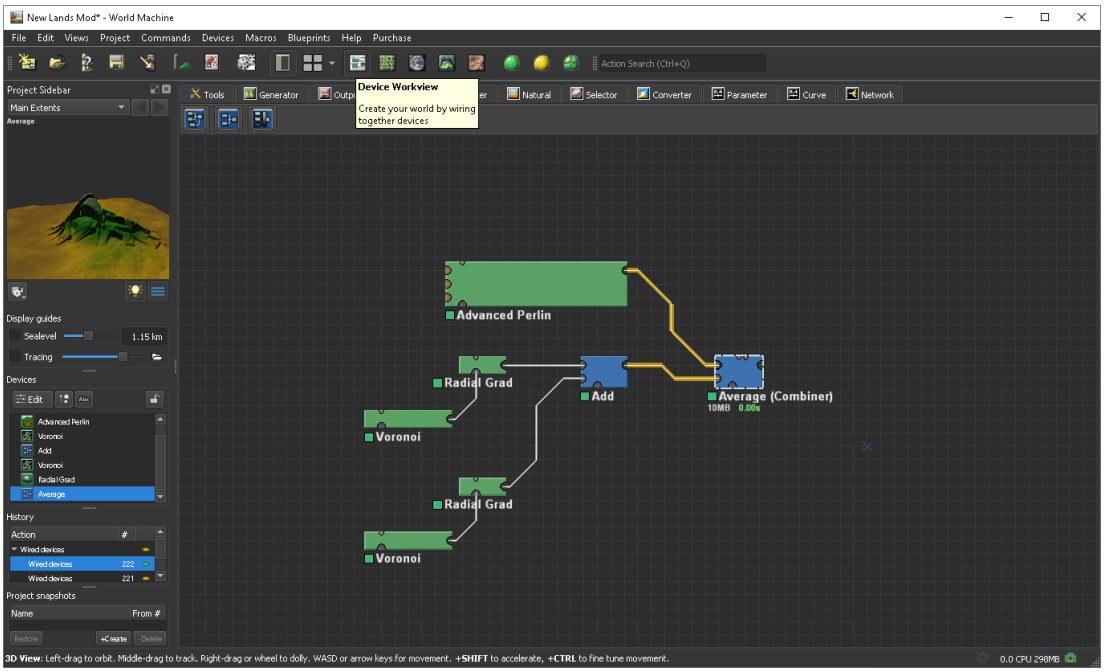

Figure 36 - Back to device workflow.

Open the properties of the second combiner node.

Set the Strength to 0.25 then click Close.

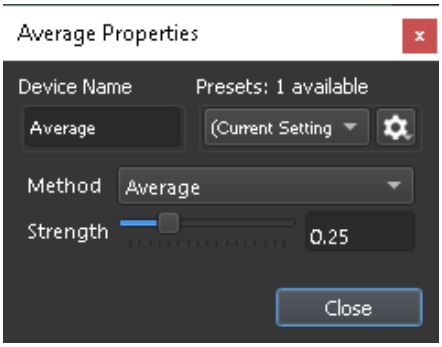

Figure 37 - Second combiner node's properties.

Under the Natural tab, click on the Erosion button to add an Erosion node.

Link the output of the second combiner node to the input of the erosion node.

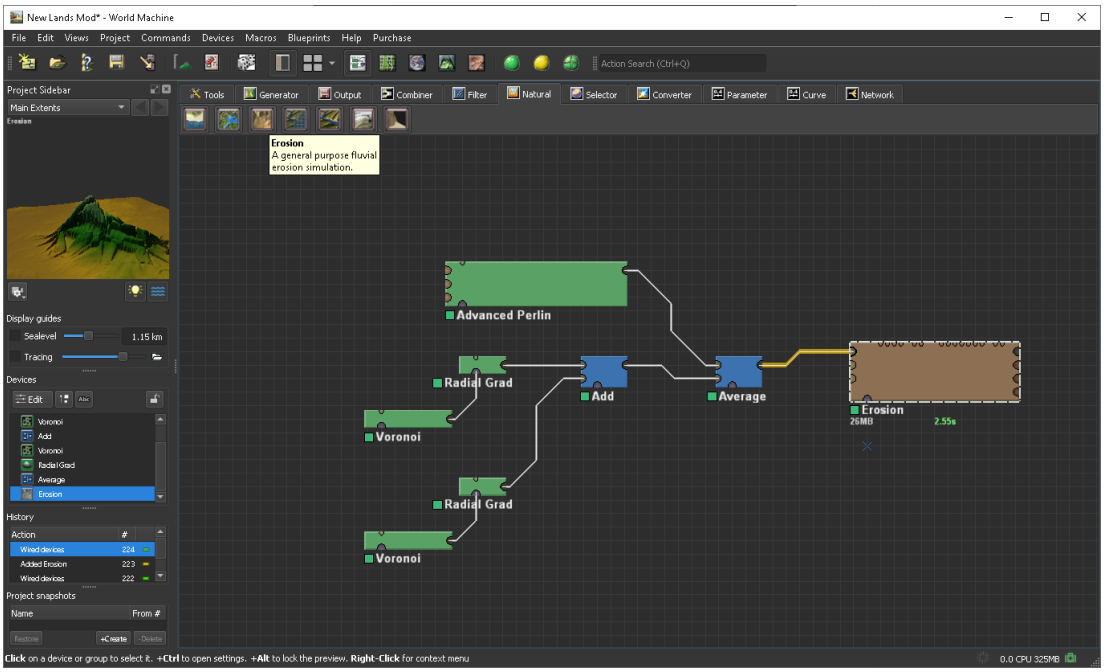

Figure 38 - Adding an erosion node.

Double-click on the erosion node to bring up its properties.

I set the Duration to 165, the Rock Hardness to 0.4 and the Sediment Carry Amount to 0.95.

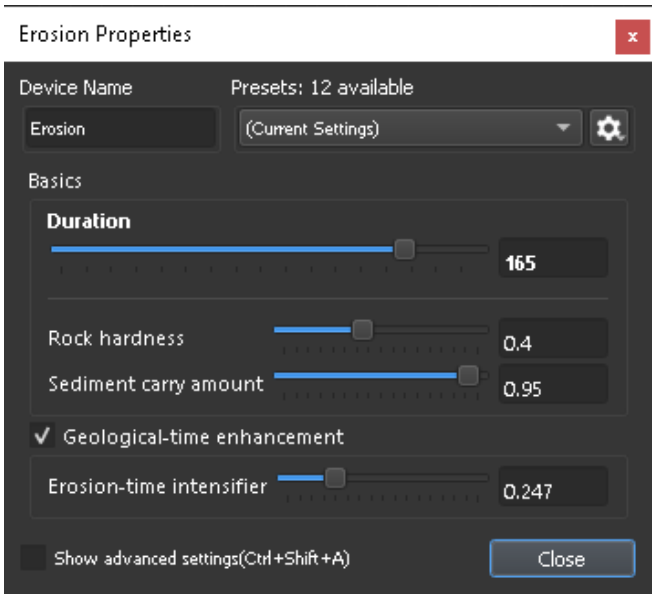

Figure 39 - Erosion properties.

Click Close.

The shape of the island should now look a little bit more realistic now that erosion is being applied.

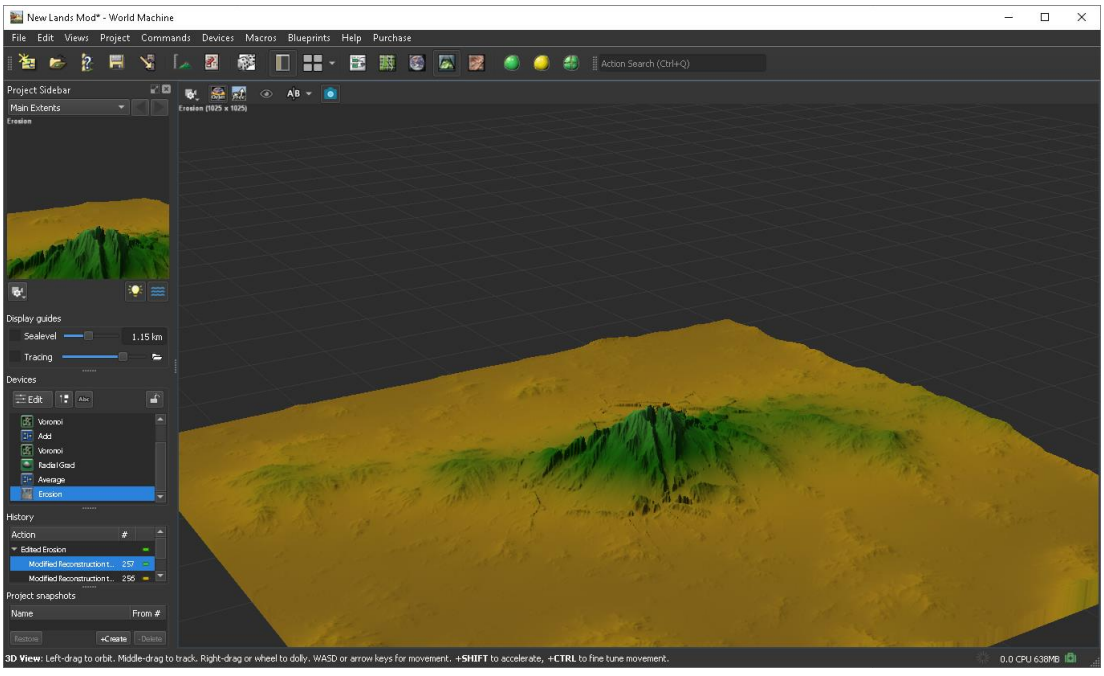

Figure 40 - The island with erosion.

Now, let's try and add some flat areas along the coast to give us some room to maybe build a settlement on.

Under the Natural tab, click on Coast Erosion and add it after the Erosion node.

Link the output of the Erosion node to the input of the Coast Erosion node.

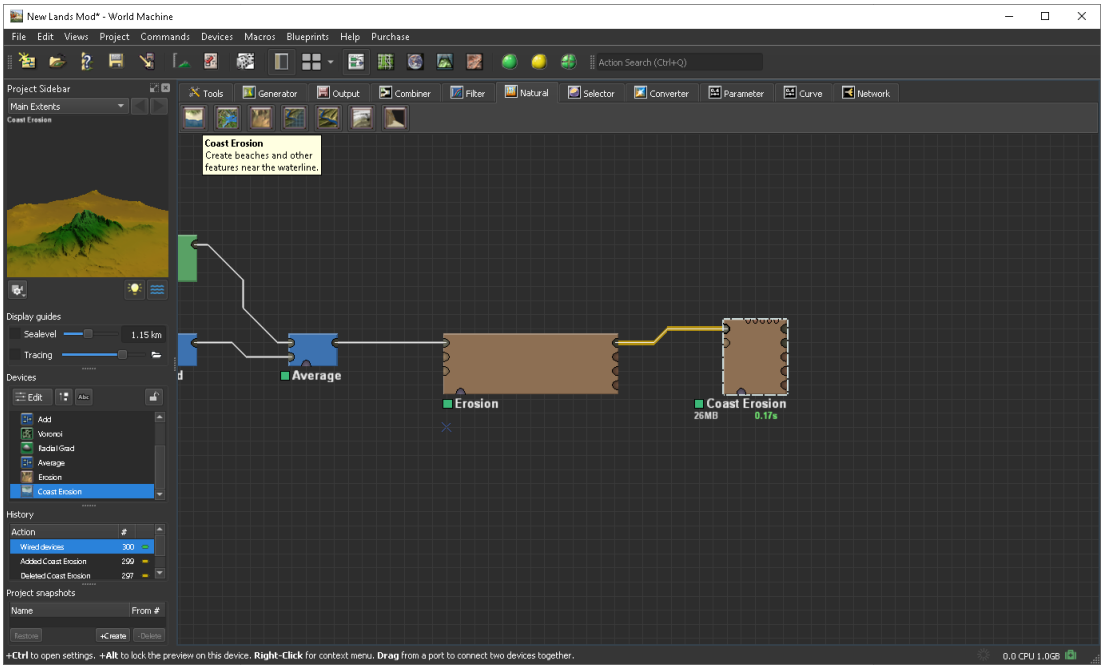

Figure 41 - Adding a Coast Erosion node.

Double-click on the Coast Erosion node to open its properties.

For this example, I set the Sea Level to 350 m, the Beach Size to 250 m, and the Inland Height Influence to 150 m.

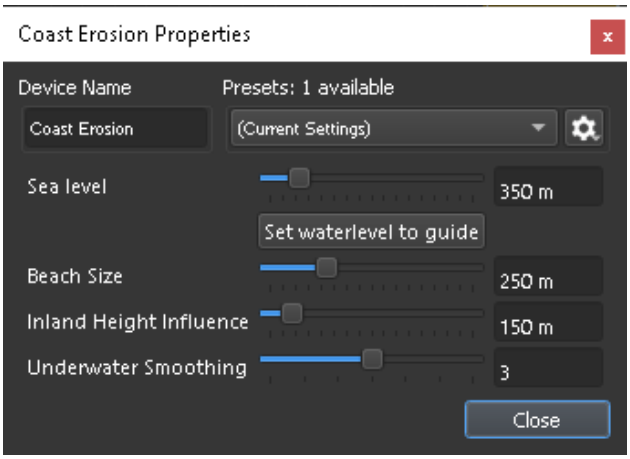

Figure 42 - Coast Erosion properties.

Click Close.

So the centre of the island still looks a bit steep, so I'm going to try and cut a bit more space out of the mountain range out with addition nodes.

Break the link between the second combiner node and the Erosion node.

Add a third Radial Grad node.

Under the Filter tab, you'll find the Inverter node. Add it in and link the output of the third Radial Grad node to the input of the Inverter node.

Lastly, add in a new combiner node. Link the output of the second combiner node to the first input of the third combiner node, and the output of the Inverter node to the second input of the third combiner node as per the screenshot below:

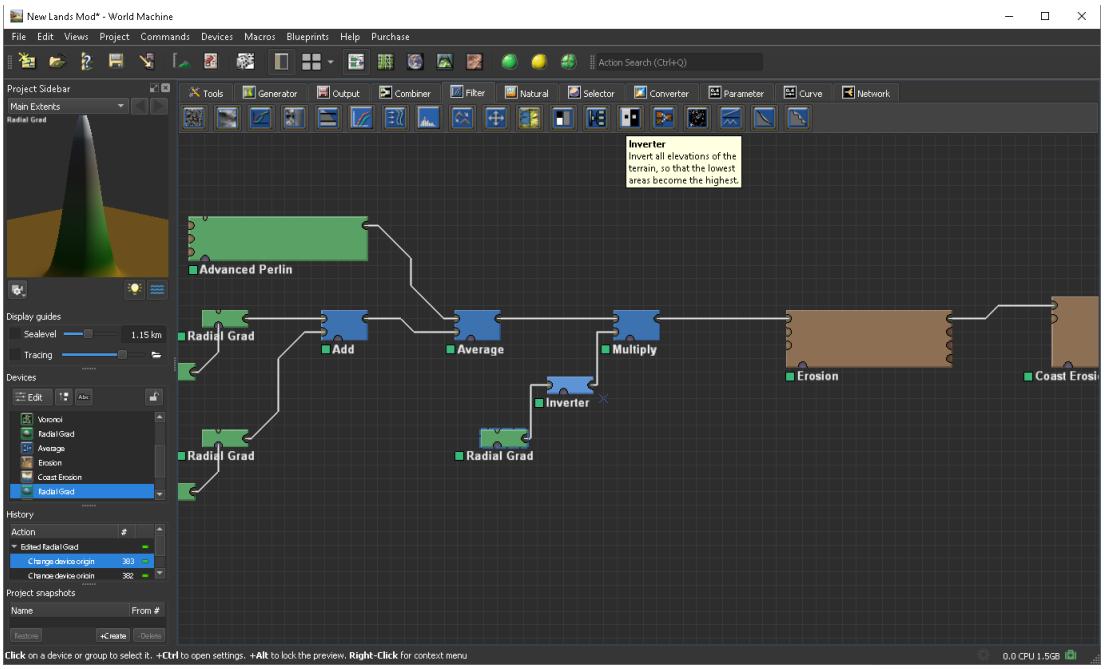

Figure 43 - Added a third combiner node.

Open the properties of the third Radial Grad node.

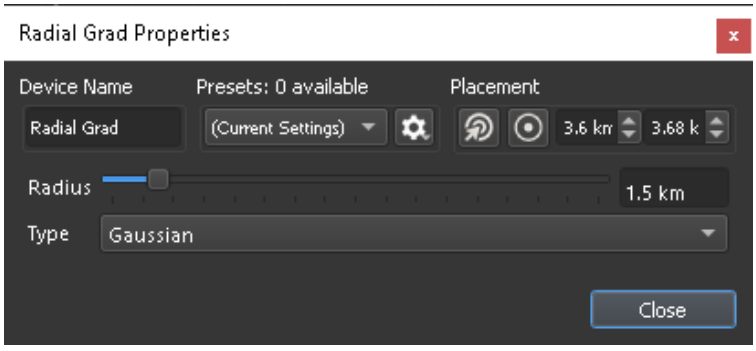

Figure 44 - Third Radial Grad node properties.

Click Close.

Open the properties of the third combiner node.

Set Method to Multiply and set the Strength to 0.7.

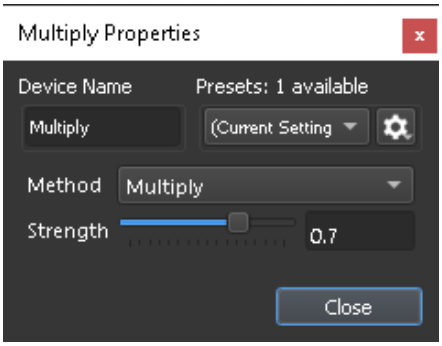

Figure 45 - Third combiner node properties.

Click Close.

We should now have a bit of a crater in the middle of the island.

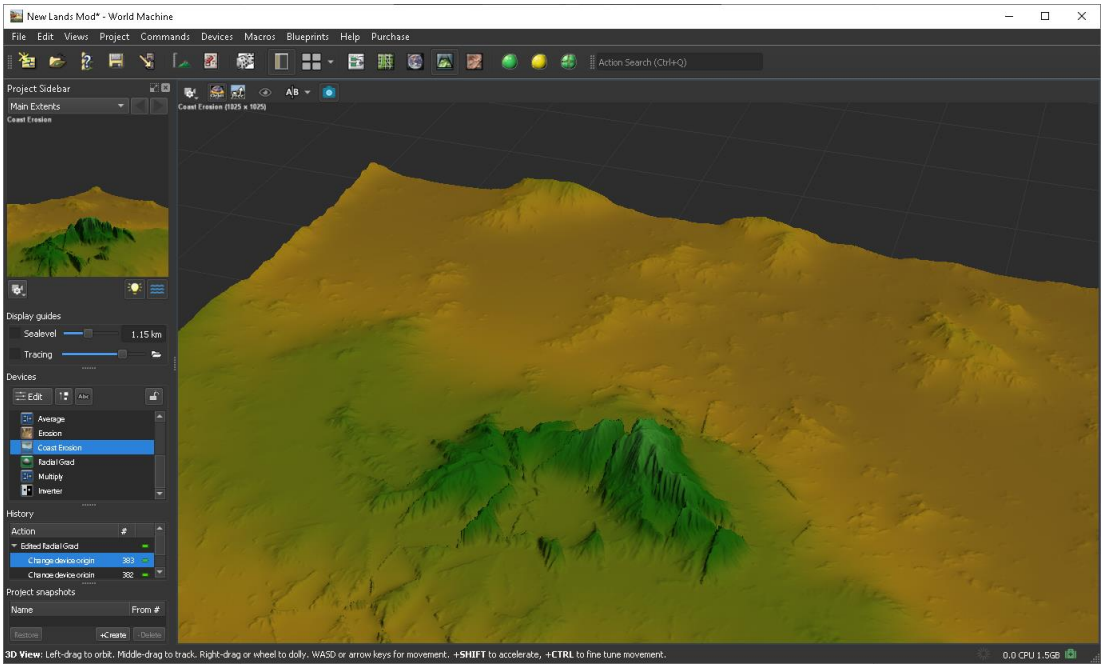

Figure 46 - Crater in the middle of the island.

Looking at the island from another angle, we can see a mountain pass as well.

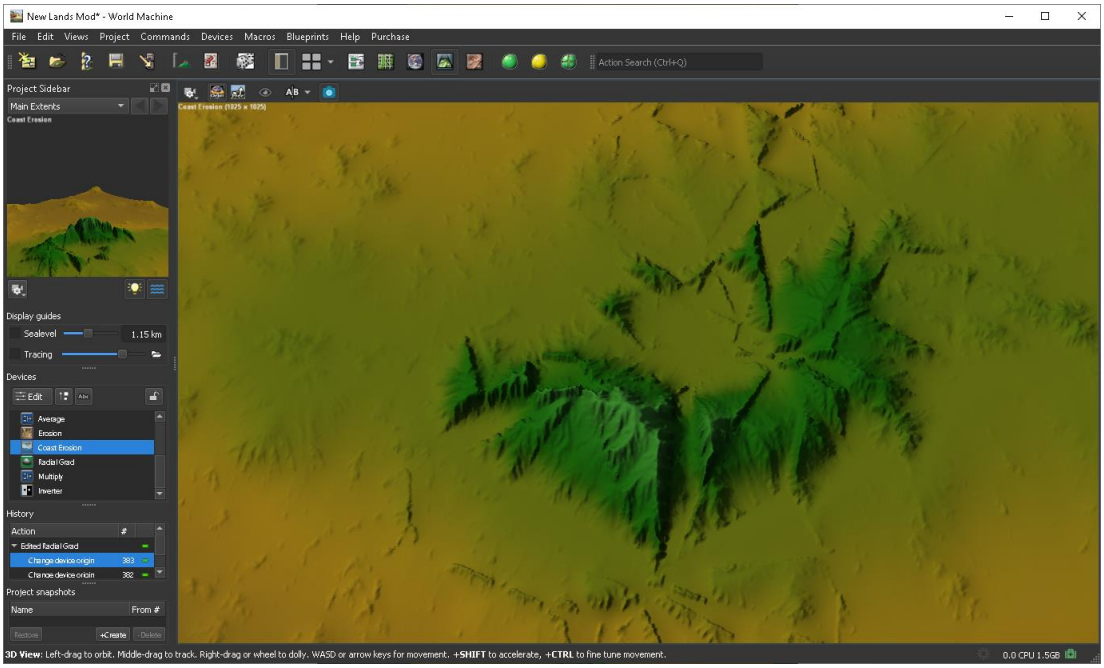

Figure 47 - The island from another angle.

The main thing to consider is the fact that Skyrim doesn't rely on the height-map to create mountain peaks. It uses static objects, so right now we're more concerned with how much playable area there is in our world space and what kind of unique geological features we can riff off-of when we begin cluttering the world space.

Looking around the height-map you'll likely see some sharp spikes sticking out. While we can easily smooth that out with the Creation Kit's landscape edit tool, let's try and save ourselves a bit of work by eroding those features in World Machine.

Under the Natural tab, click on Thermal Weathering and add it to the workspace.

Connect the output from the Coast Erosion node to the input on the Thermal Weathering node.

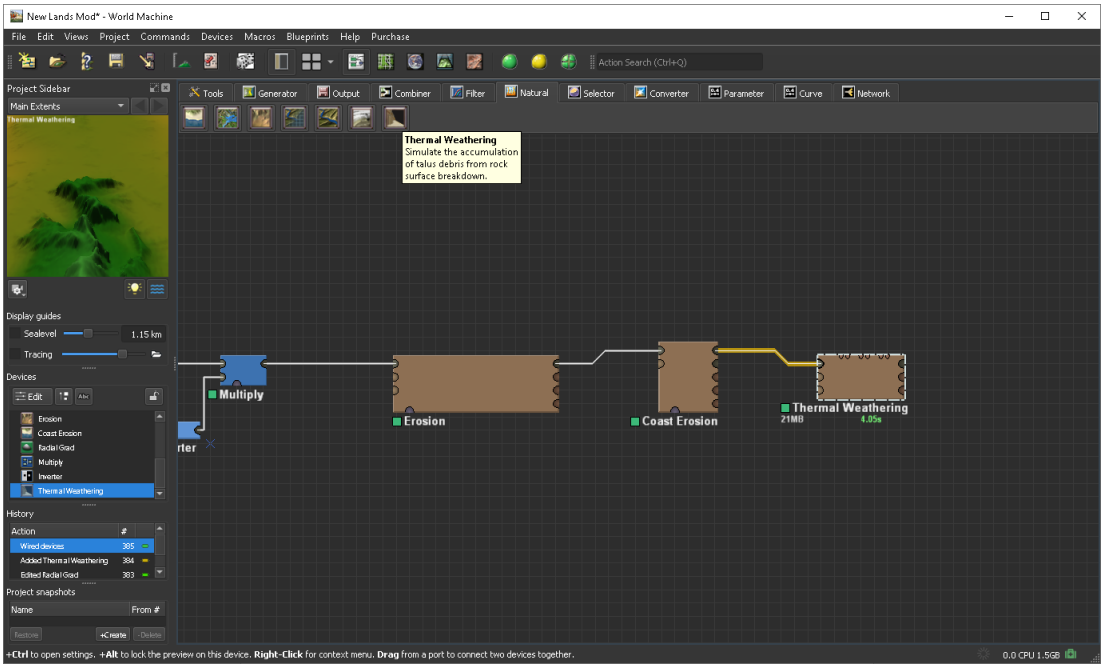

Figure 48 - Adding a Thermal Weathering node.

Double-click on the Thermal Weathering node to open its properties.

Click on 'Show advanced settings' and set the Talus Size to 20 m.

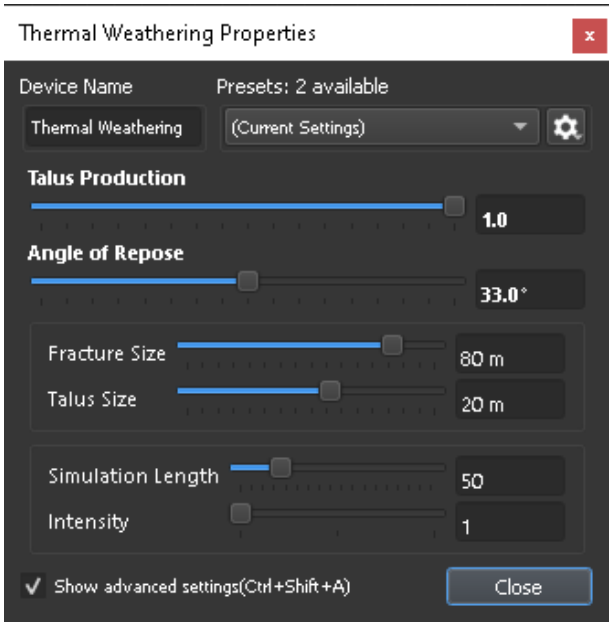

Figure 49 - Thermal Weathering properties.

Click Close.

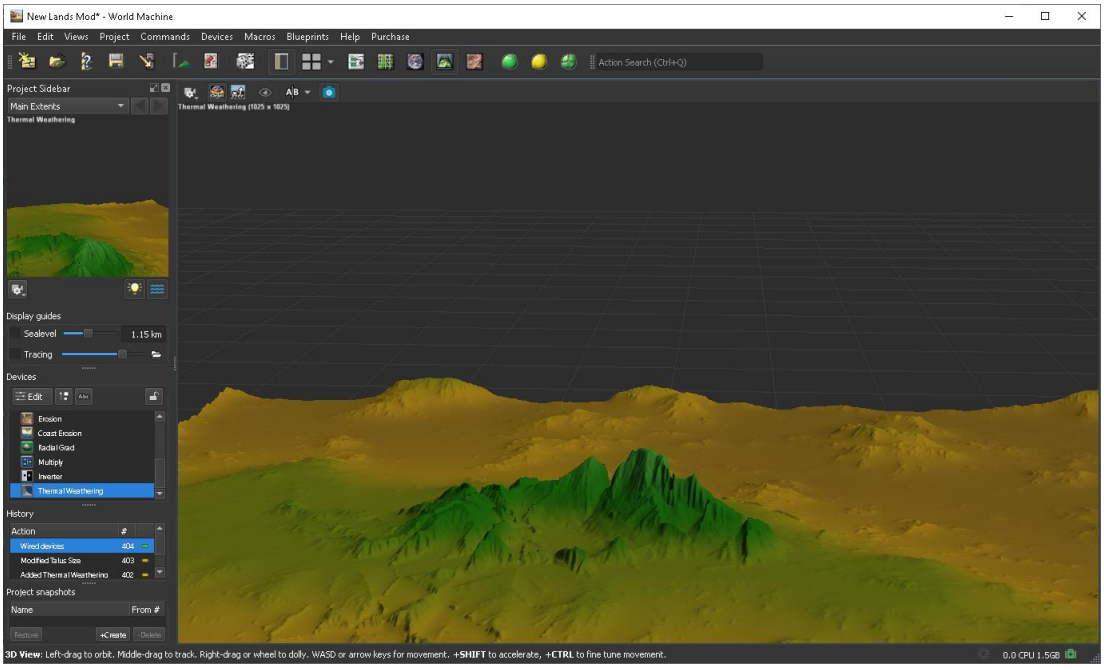

Figure 50 - The island after thermal weathering has been applied.

Go to Project > Project Settings.

Set the Resolution to 'Power of two' and the dimensions to 1024 x 1024.

Note: The free version of World Machine is limited to 1024 x 1024. If you have a license for World Machine, set this to 4096x4096 to create a -64,-64x64,64-sized world space or larger.

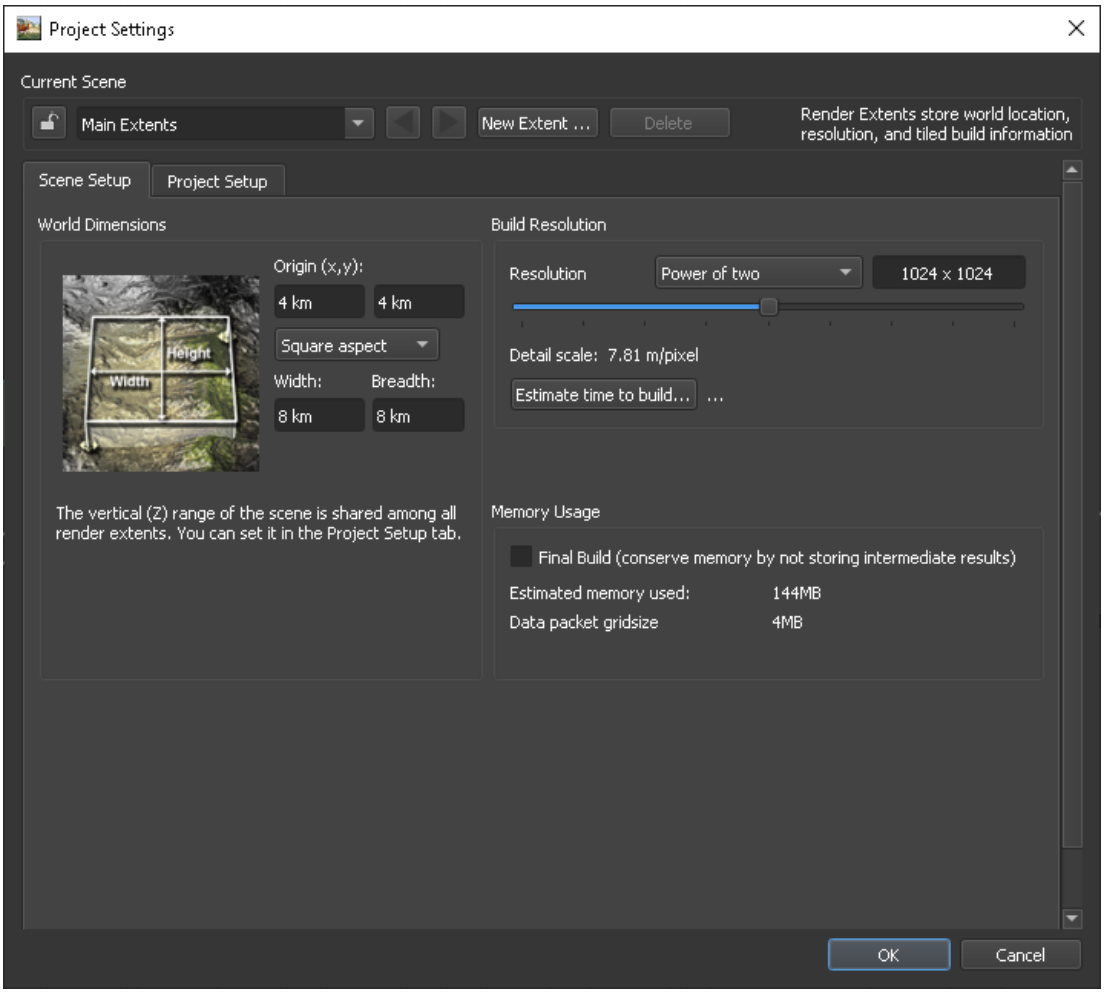

Figure 51 - Setting the build resolution.

Lastly, let's add a node to export our height-map.

Go to the Output tab, click on the Height Output button and add it to your workspace.

Connect the output of the Thermal Weathering node to the input of the Height Output node.

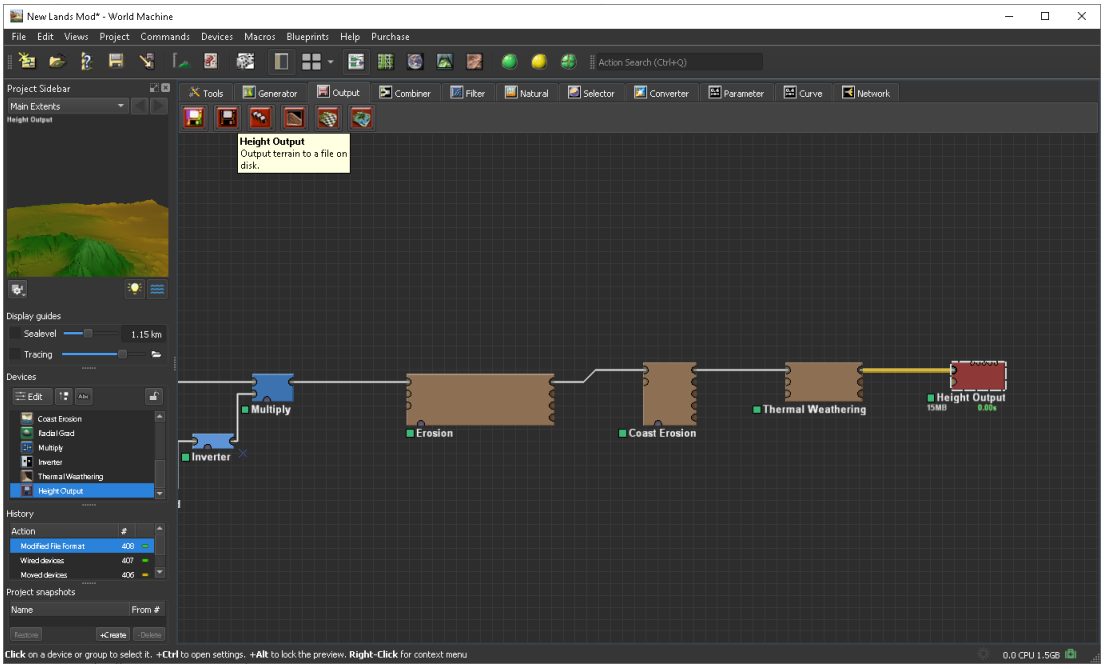

Figure 52 - Height Output node.

Double-click on the Height Output node to open its properties.

Set the File Format to 32bit Float RAW.

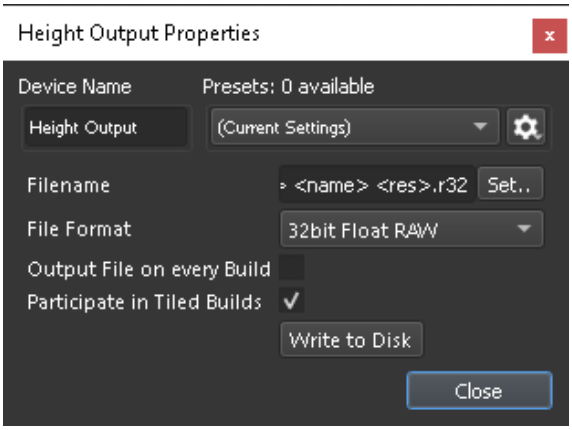

Figure 53 - Height Output properties.

Click Set.

Set the location to save the file to and the name of the .r32 file.

Ensure 'Save as type' is set to '32bit float RAW (*.r32)'.

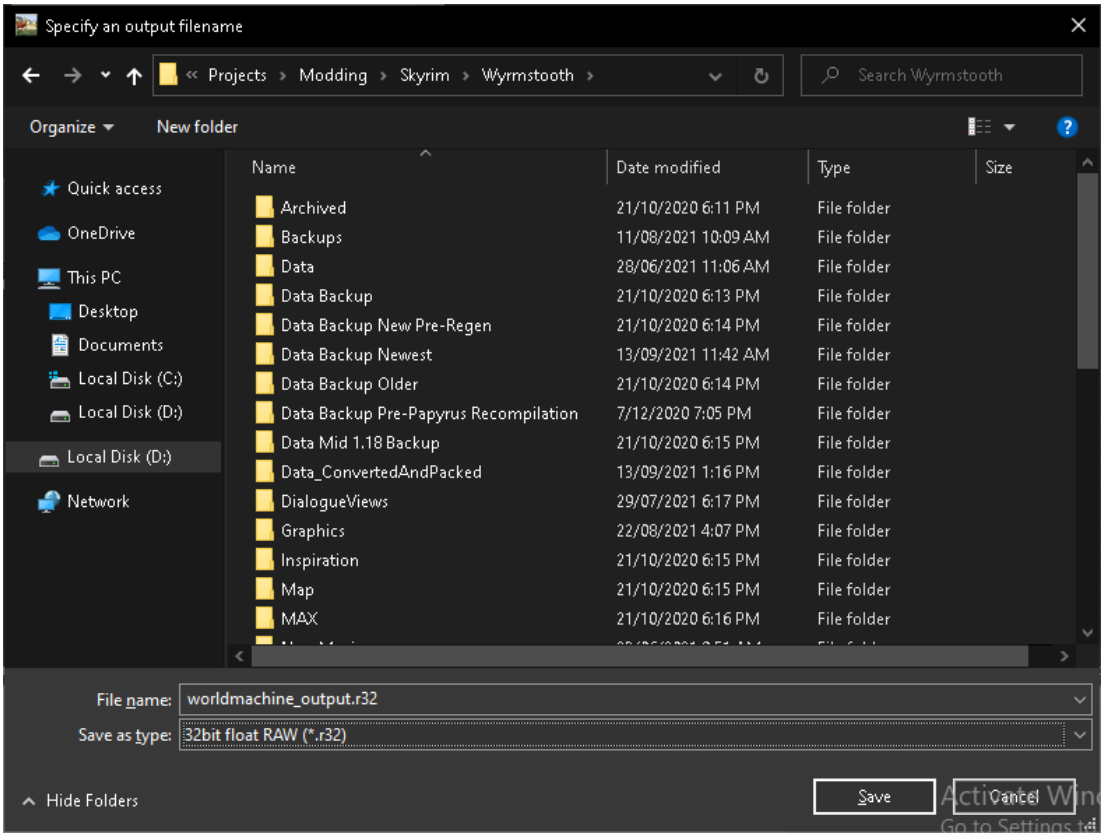

Figure 54 - Setting the location to save the .r32 file to.

Click Save.

Now click on the Write To Disk button.

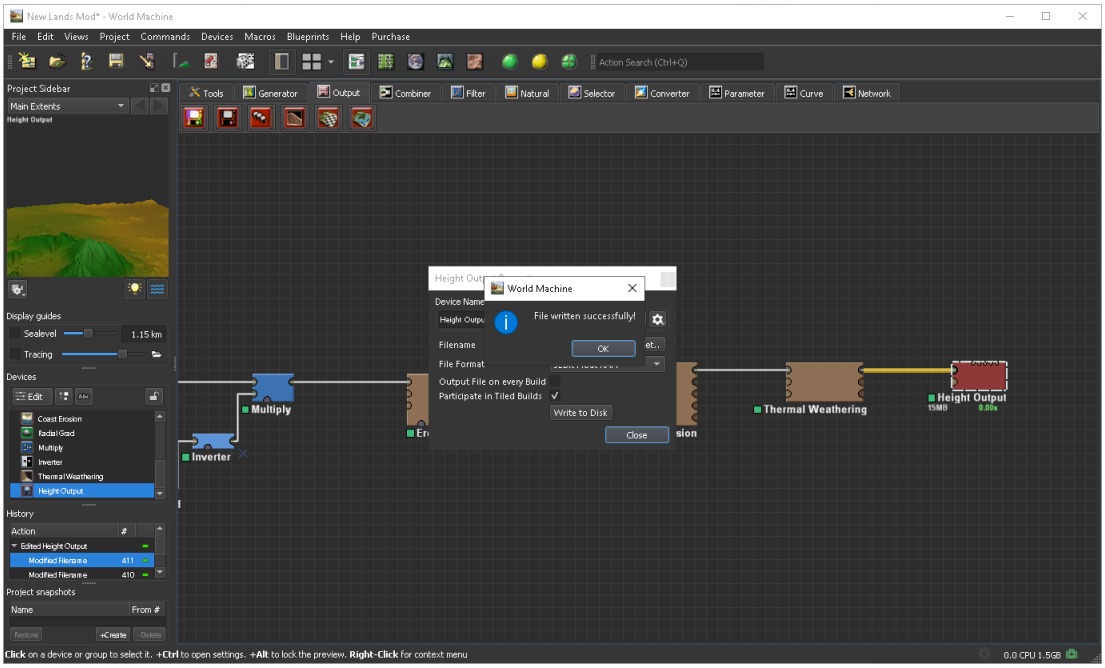

Figure 55 - Height map successfully outputted from World Machine.

Click OK to the confirmation pop-up.

Click Close to the Height Output properties.

Confirm that the .r32 file has been successfully saved to the directory you specified.

IMPORTING A HEIGHT-MAP WITH TESANNWYN

TESAnnwyn can be used to create a new .esp containing a world space based on a height map created in a terrain tool such as World Machine.

In this section I'll be importing the 1024x1024-sized height-map we created in World Machine previously.

TESAnnwyn is available for download from the Oceanlightwave website.

Extract the TESAnnwyn utility to a new folder and open a command prompt.

In the command prompt, navigate to the folder you exported TESAnnwyn to.

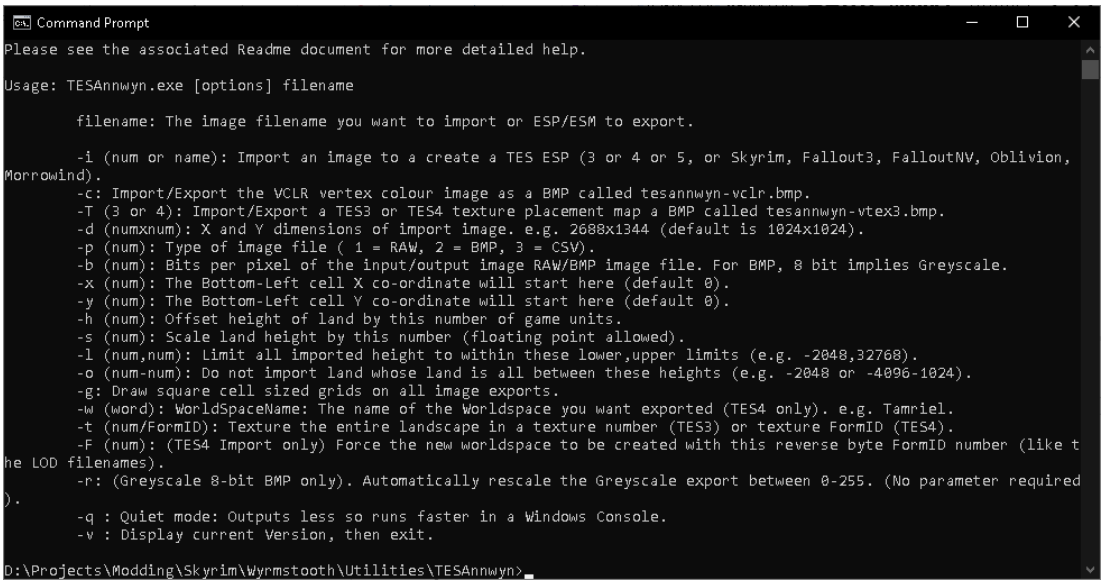

Figure 56 - TESAnnwyn options.

With TESAnnwyn, you can generate an .esp file, creating a world space based on your height map with the following command:

```
TESAnnwyn.exe -i Skyrim -p 1 -b 32 -d 1024x1024 -x -16 -y -16 -h -416000 -s
0.00005 "D:\Projects\Modding\Skyrim\Wyrmstooth\worldmachine_output.r32"
```

Replace the folder path and filename in quotes with the folder path and filename to your .r32 or .raw file.

Just a few words on the values I used in that command.

The -h switch specifies the height offset of the height map. I set this to -416000 so the land intersects the ocean plane roughly where it's supposed to. Without this switch, the height map would be far in the sky. You can adjust the height of the land and water in the Creation Kit under World > World Spaces manually, but I'd prefer to do this in TESAnnwyn at import instead.

The -s switch was set to 0.00005 to limit vertical stretching. Finding this value takes a bit of trial and error. Too low and your landscape will be completely flat. Without the -s switch, the height map is most likely going to look like jagged spikes as per the screenshot below:

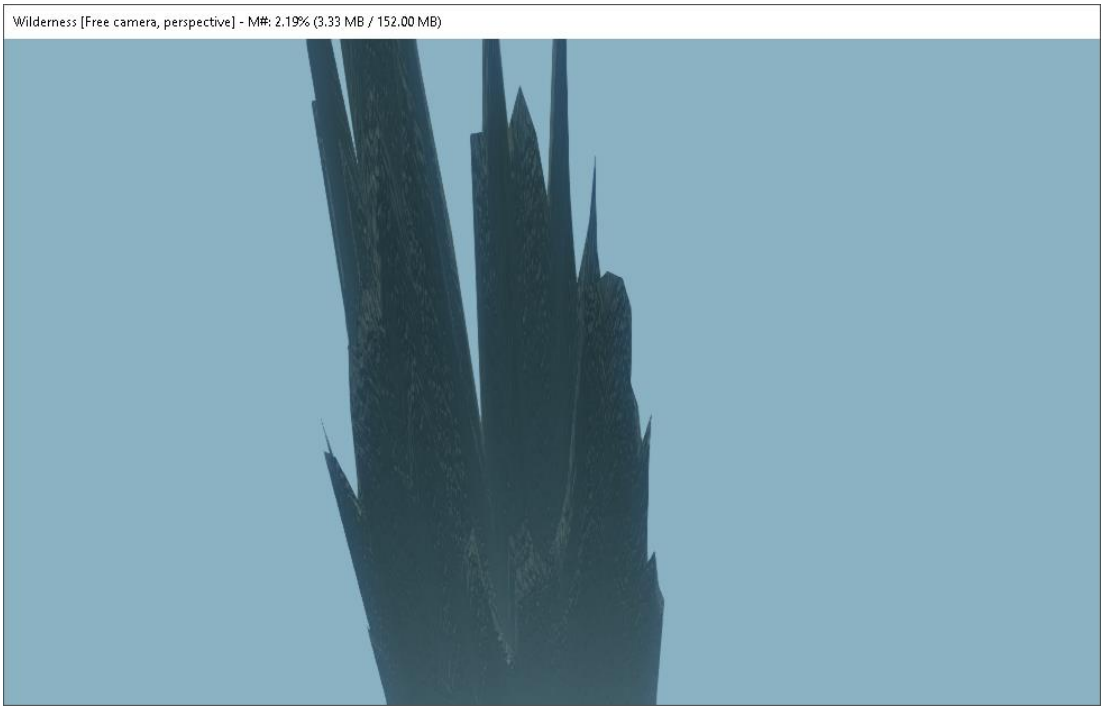

Figure 57 - No height scaling.

-x and -y set the origin cell to -16,-16. Seeing as though we're working with a small height map exported from World Machine, the size of our world space ended up being -16,-16 to 15,15. Without -x and -y, the cells will start at 0,0.

Note: You can always manually sculpt the terrain and add new cells if you want to expand the size of the island and the world space.

Lastly, the -d switch specifies the dimensions of the height map we're using. I set this to 1024x1024 as this is the size of the height map exported by World Machine. While you can double this to 2048x2048 to create a -32,-32,32,32-sized world space or 4096x4096 to create a -64,-64,64,64-sized world space using a 1024x1024-sized height map, TESAnnwyn doesn't seem to handle this particularly well and your height map will end up looking stretched on one axis.

Important: If you want a -32,-32,32,32-sized world space, use a 2048x2048-sized height map. If you want a -64,-64,64,64-sized world space, use a 4096x4096-sized height map.

For more information on the TESAnnwyn command line options, see the TESAnnwyn readme file.

When done, a new .esp file named 'tesannwyn.esp' will be created in the folder you extracted the TESAnnwyn utility to.

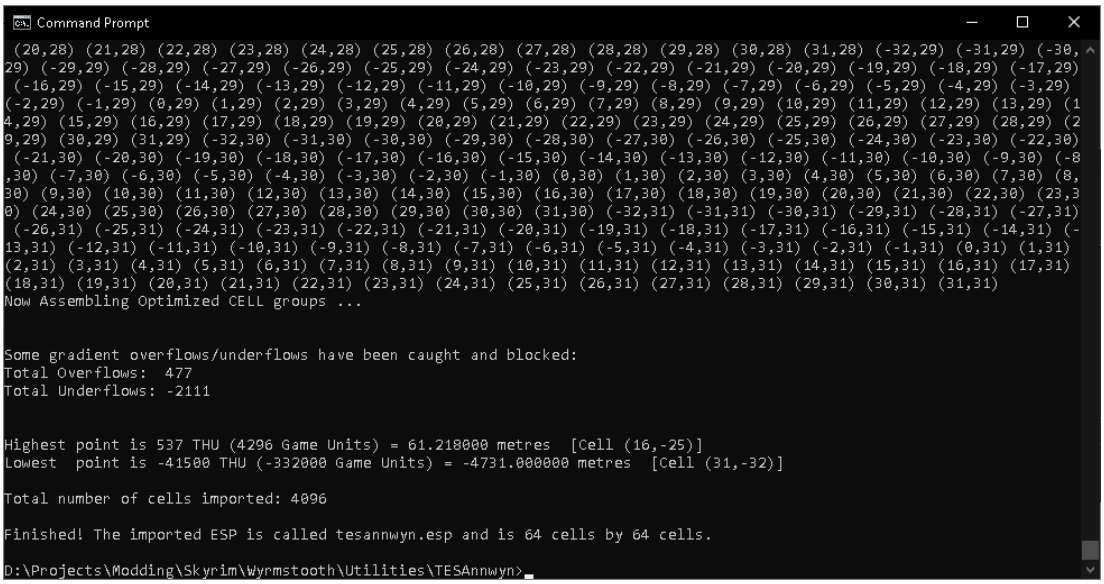

Figure 58 - TESAnnwyn finished.

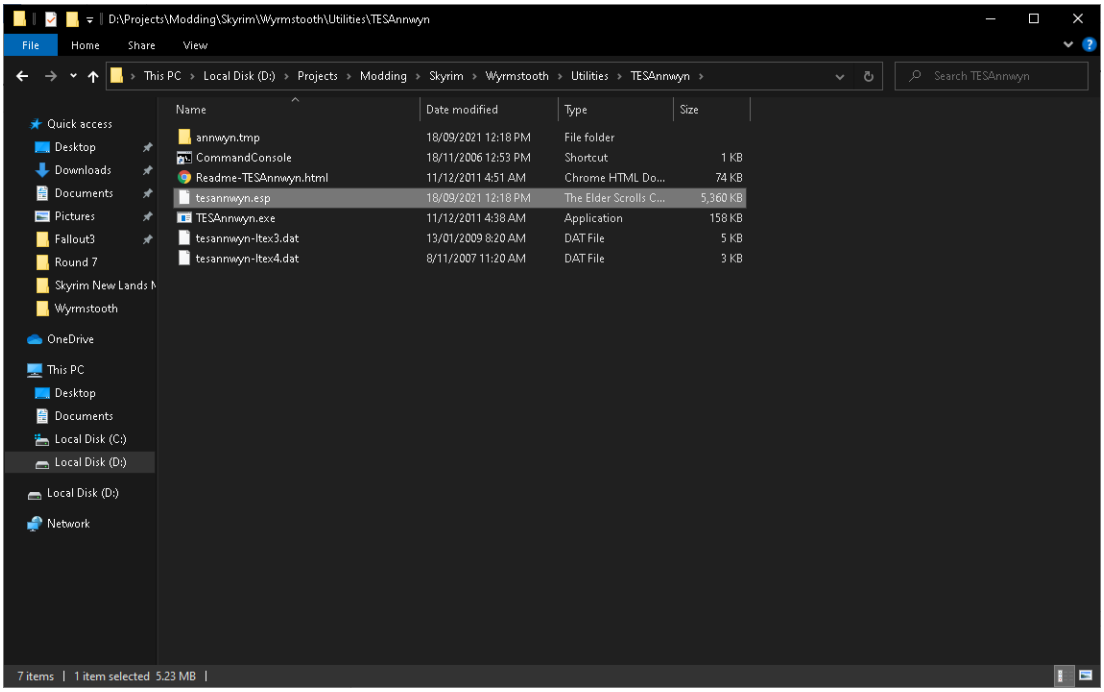

Figure 59 - tesannwyn.esp.

Copy this file to your Skyrim\Data or Skyrim Special Edition\Data folder.

You can rename this file however you like.

Launch the Creation Kit.

Go to File > Data.

Tick the Skyrim.esm file in the Plugin/Master Files list.

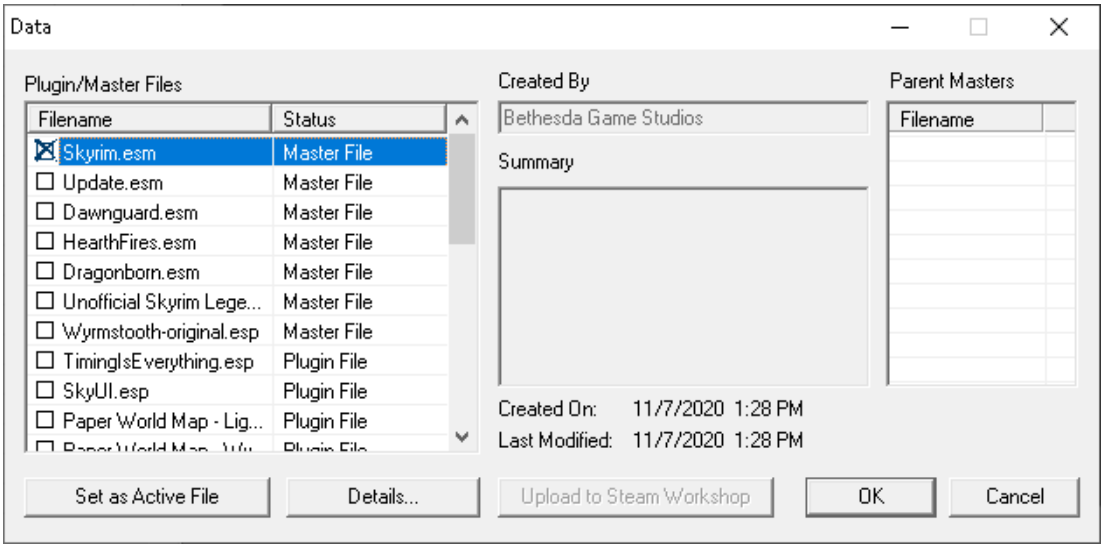

Figure 60 - Ticking the Skyrim.esm master file.

Tick the .esp file created by TESAnnwyn and click 'Set as Active File'.

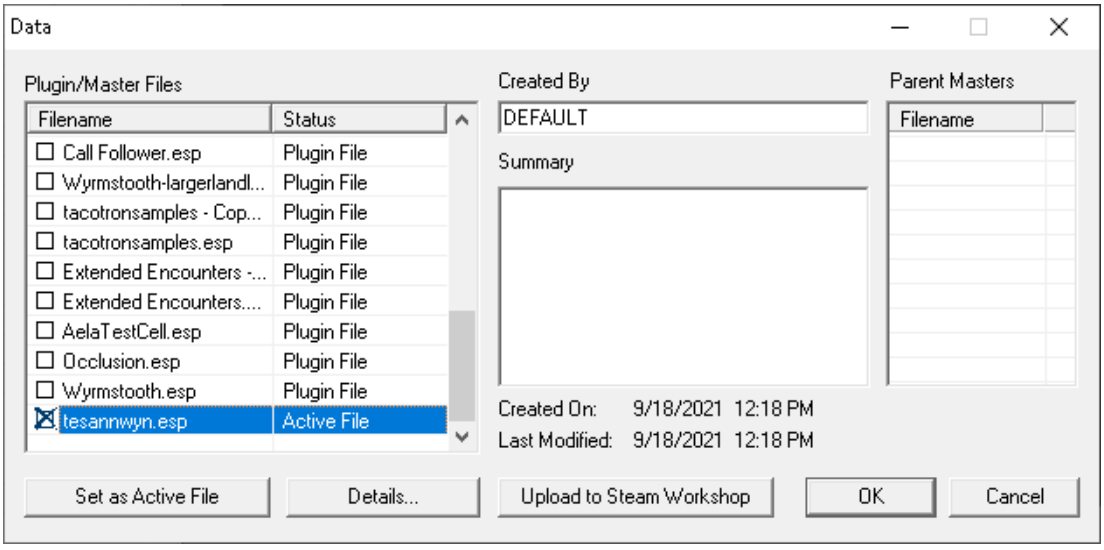

Figure 61 - Setting the tesannwyn output .esp as the active file.

Click on the OK button to begin loading it.

Go to World > World Spaces.

You should see a TESAnnwyn world space listed.

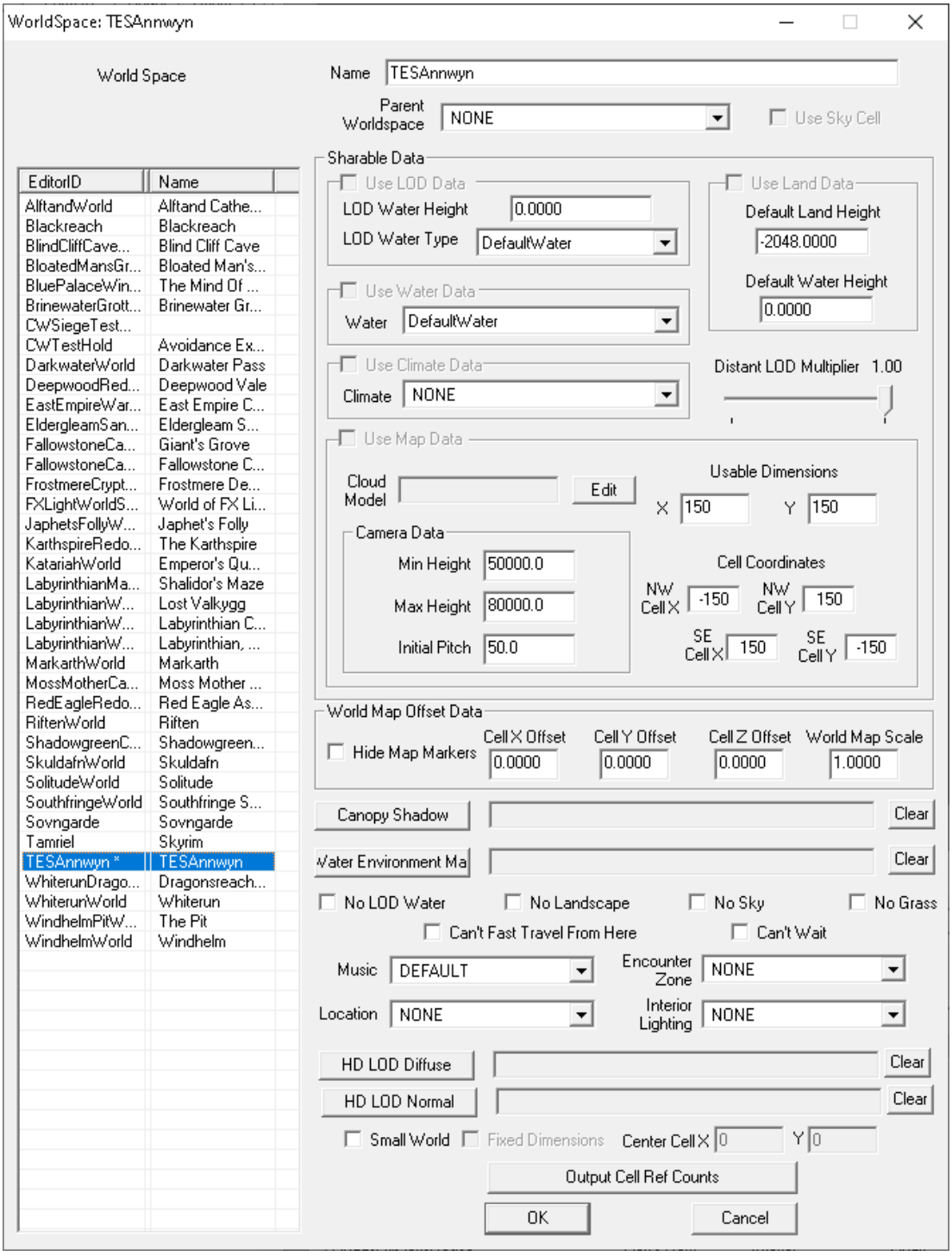

Figure 62 - TESAnnwyn world space.

Press 'F2' and rename this world space to whatever you like, then click OK.

In Cell View, select your world space then double-click on one of the cells to load it.

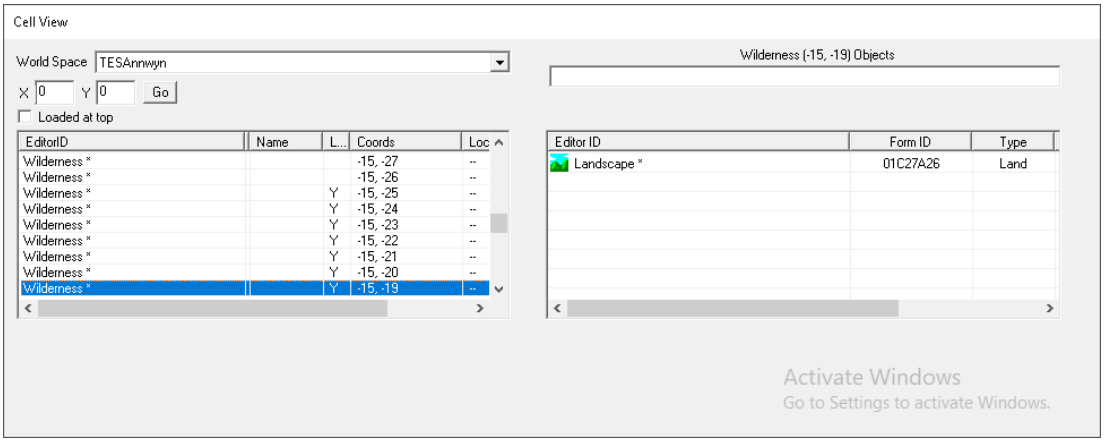

Figure 63 - Loading the world space.

And there's our height map in the render window.

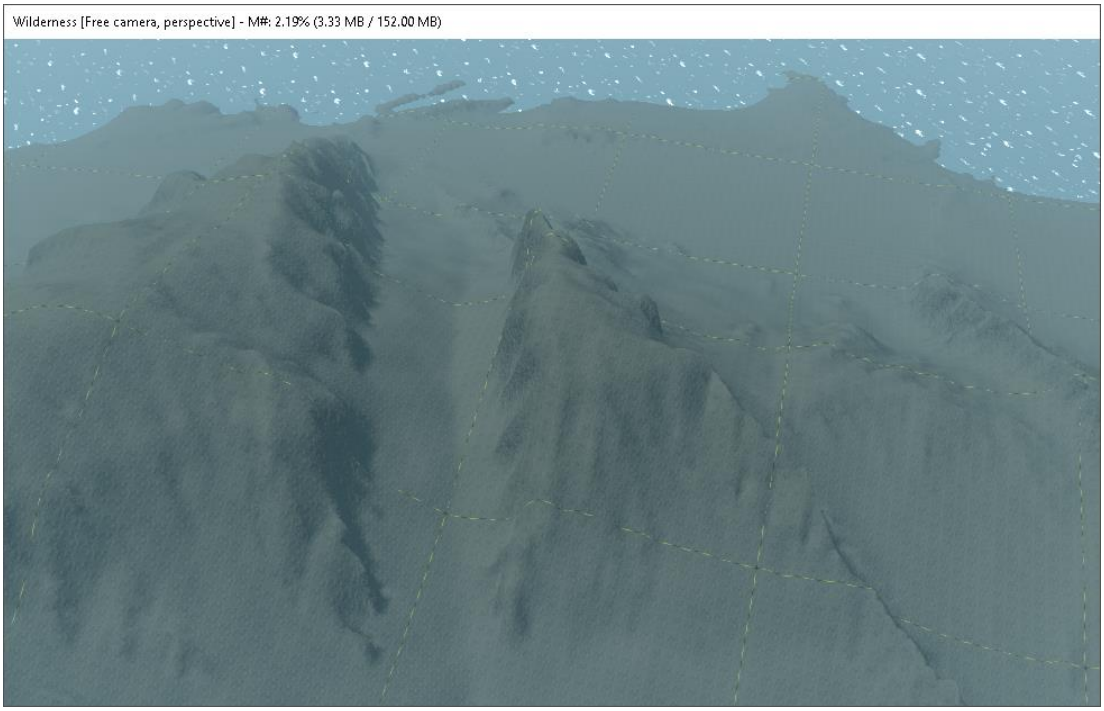

Figure 64 - Height map in the render window.

Note: If you see holes in your landscape, your height map may be too steep. Reduce the value in the -s switch in TESAnnwyn further to reduce the steepness of the mountains.

SCULPTING A LANDSCAPE WITH THE LANDSCAPE EDIT TOOL

The landscape edit tool is the tool we'll be using to manually sculpt the landscape in our world space. This tool can be used to raise or lower our terrain and flatten or smoothen slopes. Later on we'll also use it to paint landscape textures.

Press 'H' to bring up the landscape edit tool.

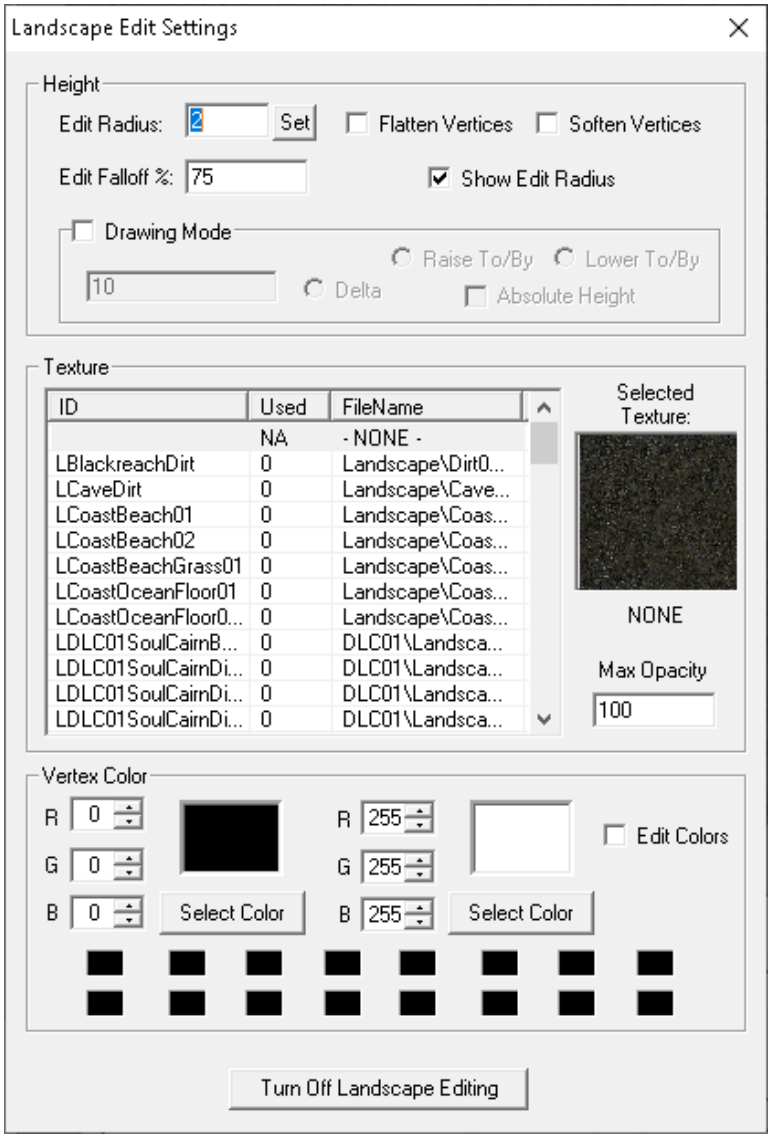

Figure 65 - The Landscape Edit tool.

The Edit Radius shows the current radius of the landscape edit tool. This the red circle that appears around the mouse cursor in the render window when the landscape edit tool is enabled.

The Edit Falloff represents the hardness of the brush. It's like brush hardness in image editing programs. The lower the number the softer the edge.

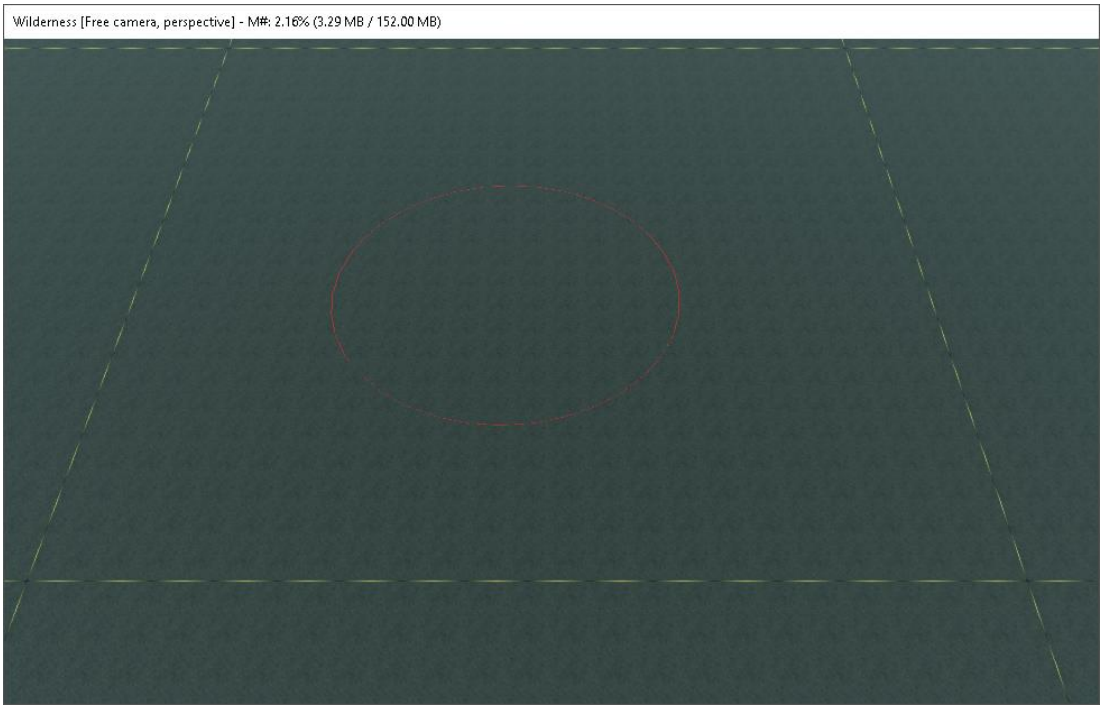

Figure 66 - Edit Radius.

Set the Edit Radius to 9.

Note: You can also use the '[' key to reduce the Edit Radius by one and ']' to increase the Edit Radius by one.

In the following examples, I'll be picking up where I left off in the first chapter.

At the moment our landscape is still entirely underwater. We'll need to see the landscape as we're sculpting, so press 'M' to bring up the Show/Hide menu and untick Water to hide it for now.

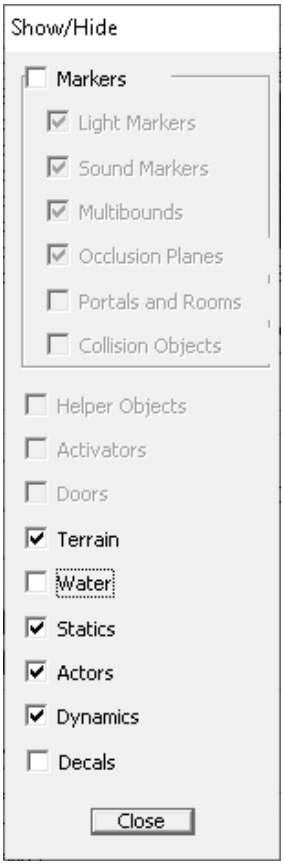

Figure 67 - Turning water rendering off.

Let's start by raising some land up from the sea floor. Left-click and drag the terrain up in the render window.

We should now have a bit of a mountain sticking up from the sea floor.

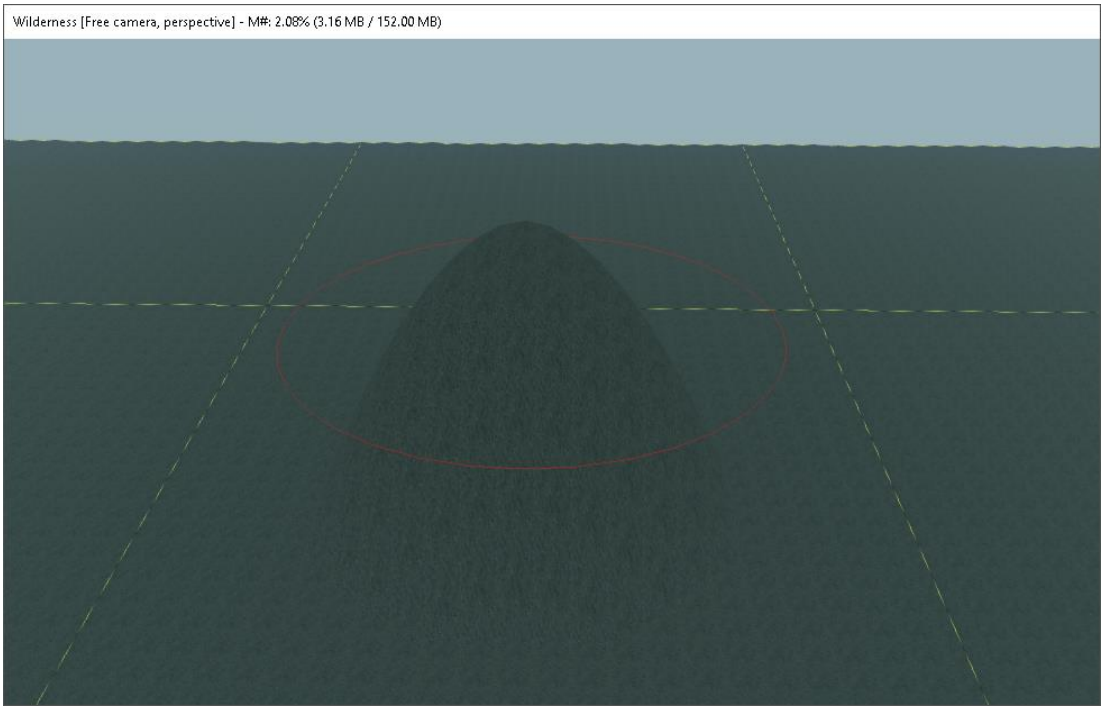

Figure 68 - Dragging terrain up.

Note: If you see floating grass or rocks up in the sky, just ignore it. This is a bug.

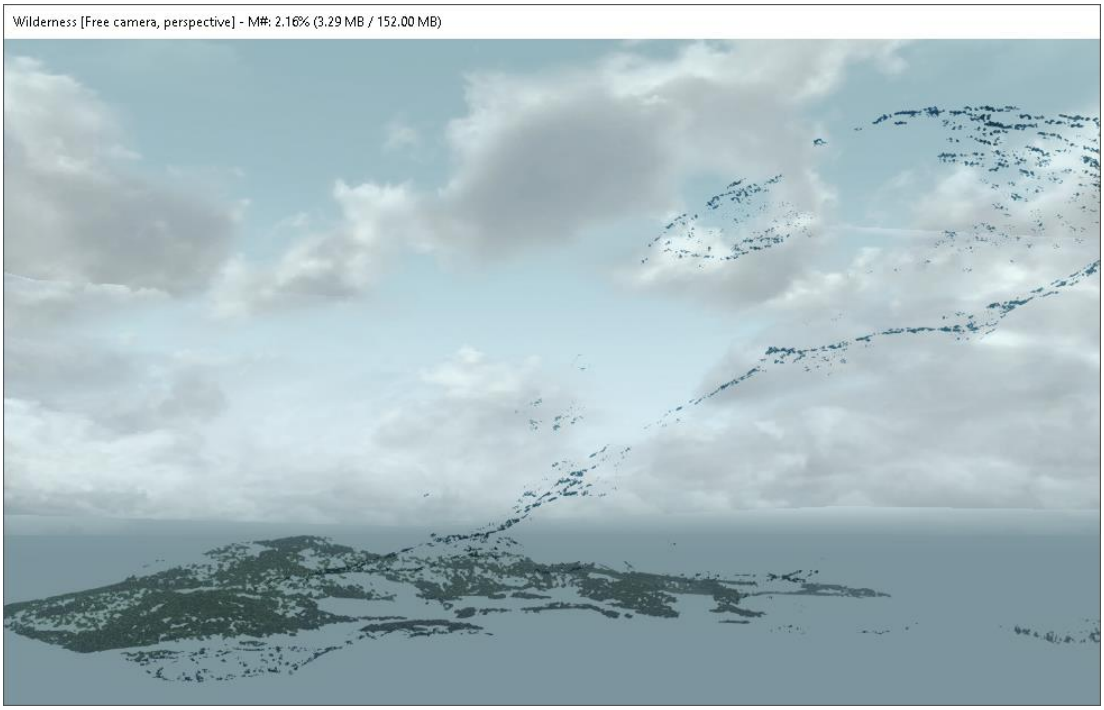

Figure 69 - Ignore the floating rocks and grass.

If we turn water back on in Show/Hide, our render window should now look like this:

Figure 70 - A bit of land poking through the ocean.

Let's increase the size of our shoreline next.

Important: If the Creation Kit crashes when editing your world space for the first time, make a small adjustment to the landscape first, then save your mod. If you press 'B' to show cell borders, but cell borders aren't being overlaid on the landscape, you might be in for a crash.

Set the Edit Radius to 4 and tick 'Flatten Vertices'.

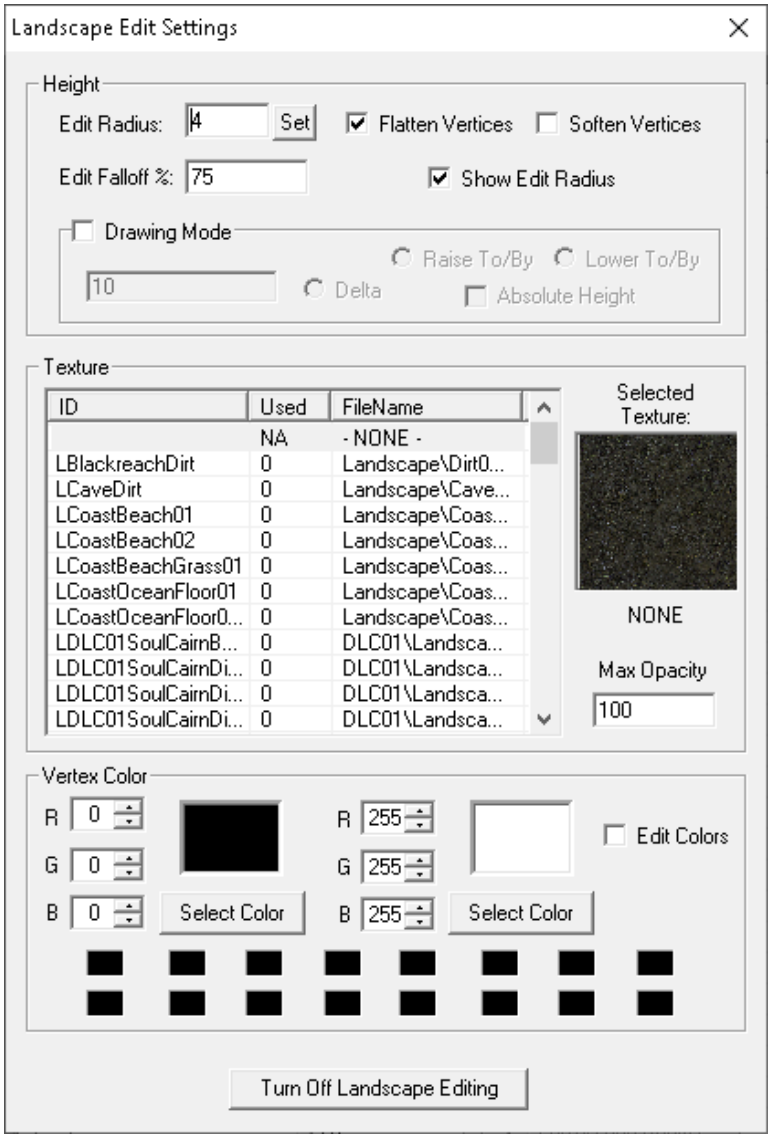

Figure 71 - Turning on Flatten Vertices mode.

Left-click and drag on the land poking above the water.

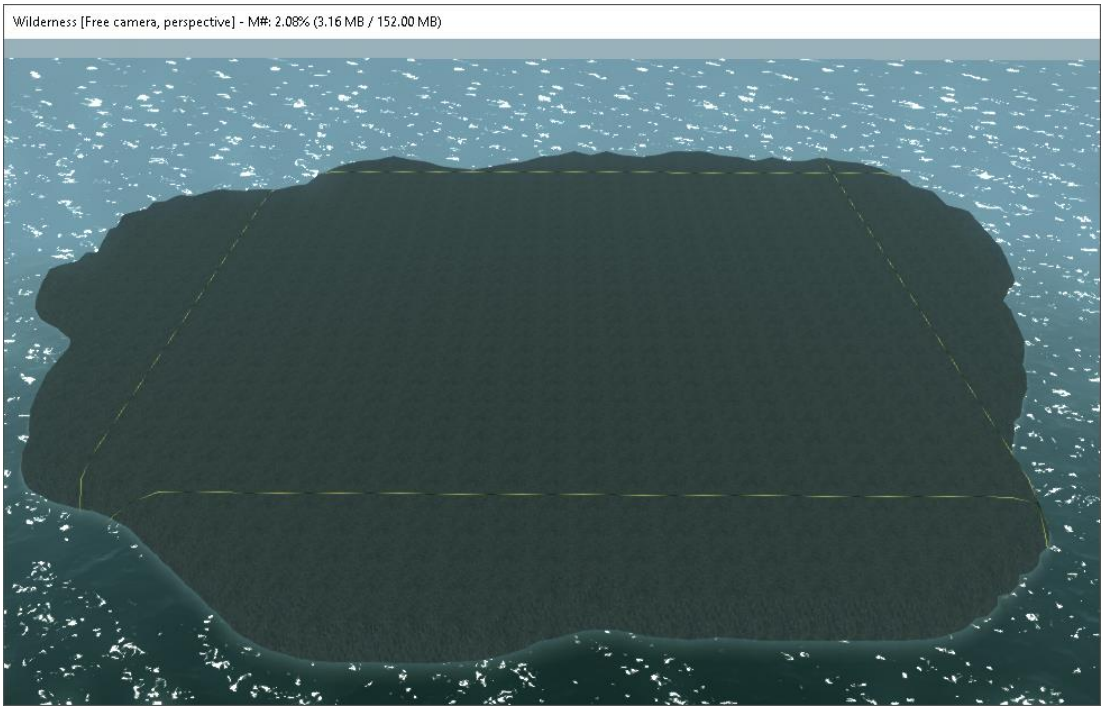

Figure 72 - We now have a bit of an island.

When you left-click and start dragging with Flatten Vertices ticked, the height of the landscape you drag over will be set to the same level as the part of the landscape you began dragging from.

Anything below the ocean will be raised up, similarly, any hills above the point where you began dragging from will be lowered. We can use Flatten Vertices to quickly create the outline of an island.

If we turn off water again, we'll see that the slope from the ocean floor to the top of our island is rather steep.

So let's smoothen that out a bit.

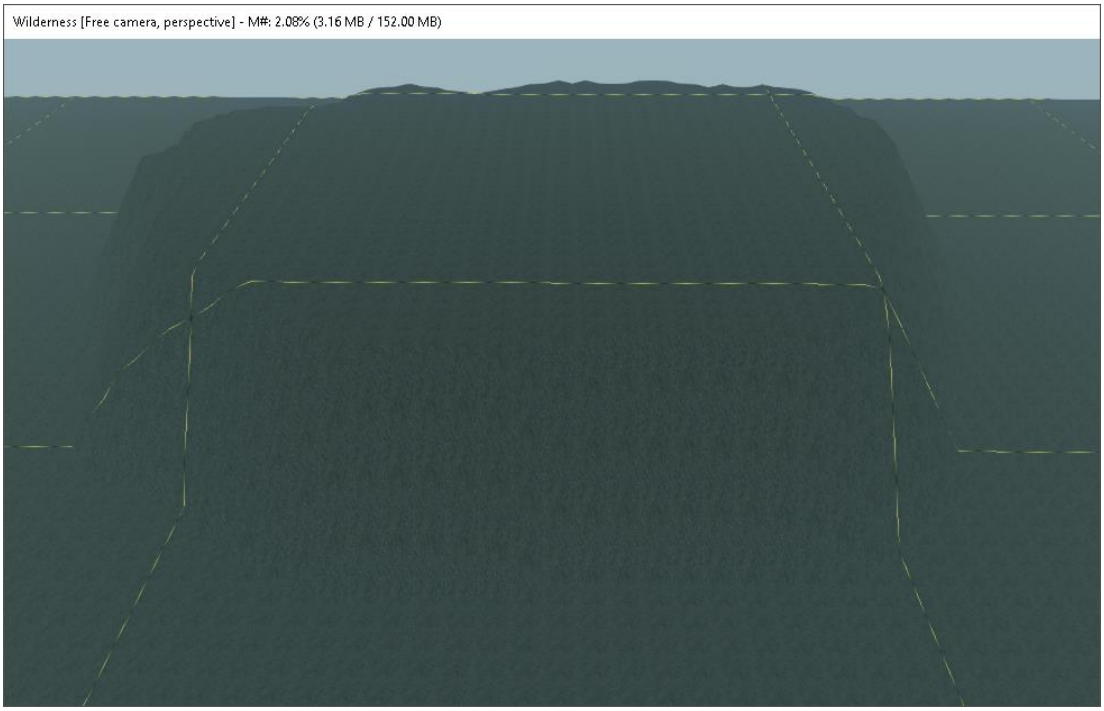

Figure 73 - Steep slopes from ocean floor to island surface.

In the landscape edit tool, tick 'Soften Vertices'. This will automatically untick 'Flatten Vertices' and vice versa.

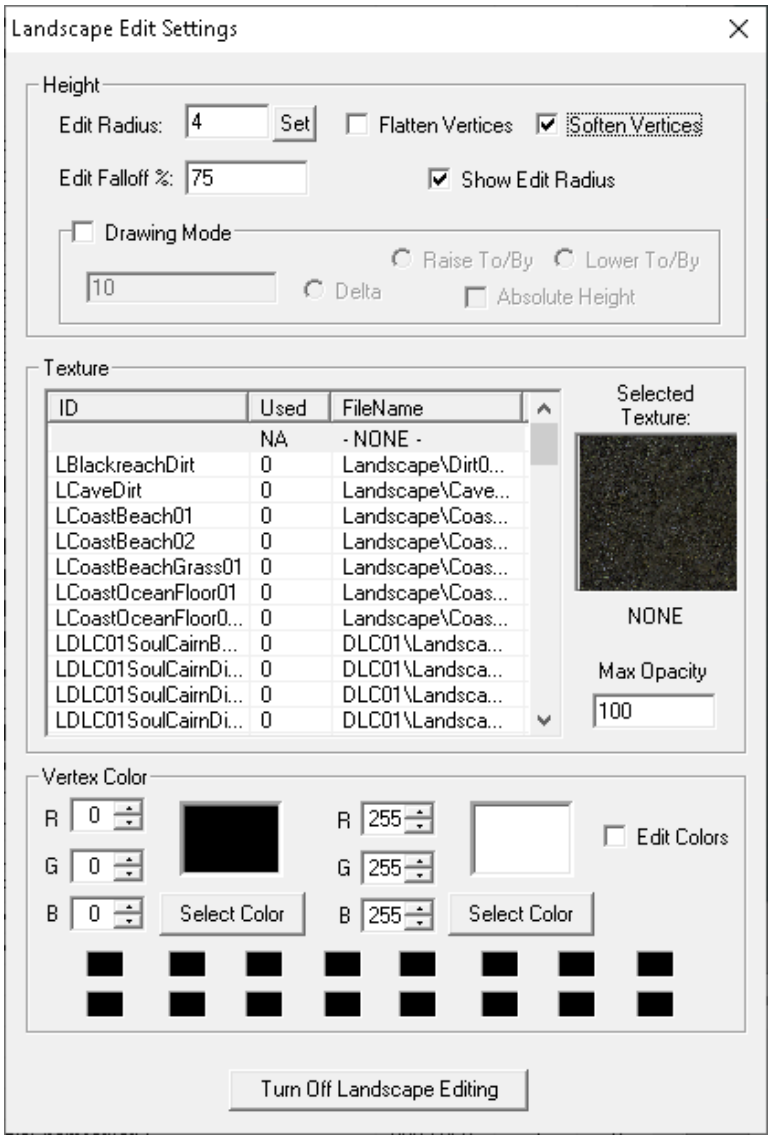

Figure 74 - Turning on Soften Vertices mode.

Left-click and drag along the slope to reduce its steepness.

When softening the slope, try not to do it too evenly so it looks a bit more natural.

Our island should now look a bit more like this.

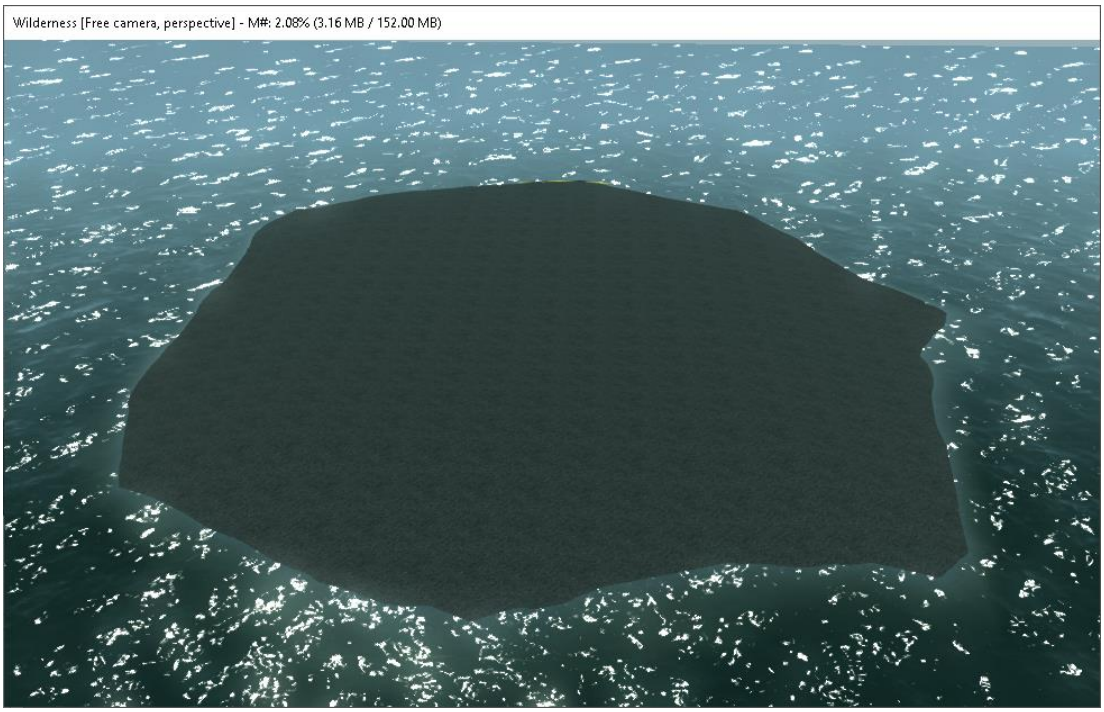

Figure 75 - Softened slopes around the shoreline of our island.

Important: When sculpting with the landscape edit tool, I would not recommend setting the Edit Radius above 14. It might lead to issues panning around your scene and the edit radius indicator might disappear.

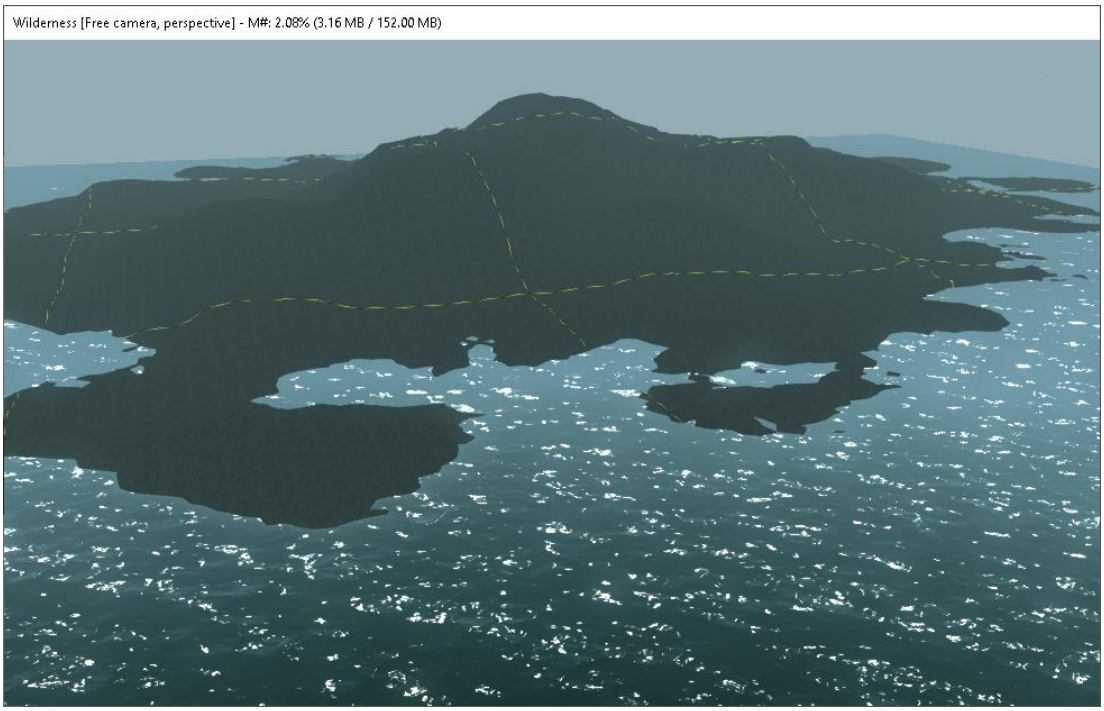

Figure 76 - The island gets a bit bigger.

In the screenshot above I added some flat areas near the shoreline around a central hill; enough room perhaps for a small town. Some tidal pools and small islands were added around the coast of our main island to help make the shoreline look a bit more natural.

I also added some shallows for the player to stand in, before the landscape drops off to the ocean floor.

To better understand the scale of your landscape as you sculpt it, you can toggle cell borders by pressing the 'B' key.

While sculpting your island, I'd also recommend increasing the number of cells loaded.

Go to File > Preferences and go to the Misc tab.

Set the 'Grids to Load' to 9 then click Apply.

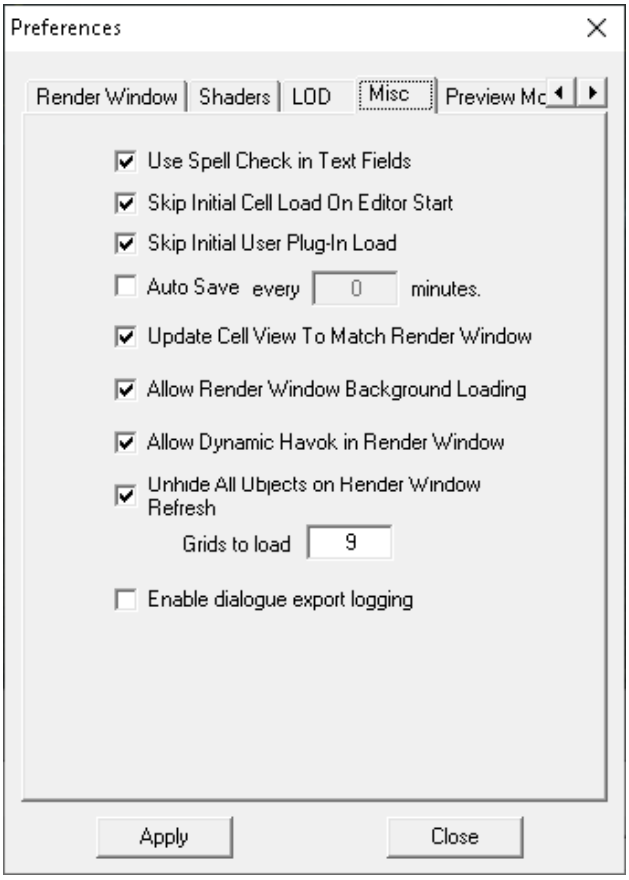

Figure 77 - Increasing Grids to Load.

This will increase the number of cells loaded into the preview window. Just be careful with how high you set this value.

Important: Setting Grids to Load too high may inadvertently crash the Creation Kit, especially with a fully cluttered landscape.

ADDING LANDSCAPE TEXTURES

Landscape textures can also be added using the landscape edit tool.

Important: If you want to learn how to automatically paint your terrain based on slope, altitude and object placement, see Region generated textures and objects.

Press 'H' to bring up the landscape edit tool if you don't already have it open and press 'B' to toggle cell borders.

Before we start adding textures to a landscape, it's important to consider how each cell is divided and the texture limitations we'll need to be aware of.

Each cell consists of 4 quads. The screenshot below should help illustrate this:

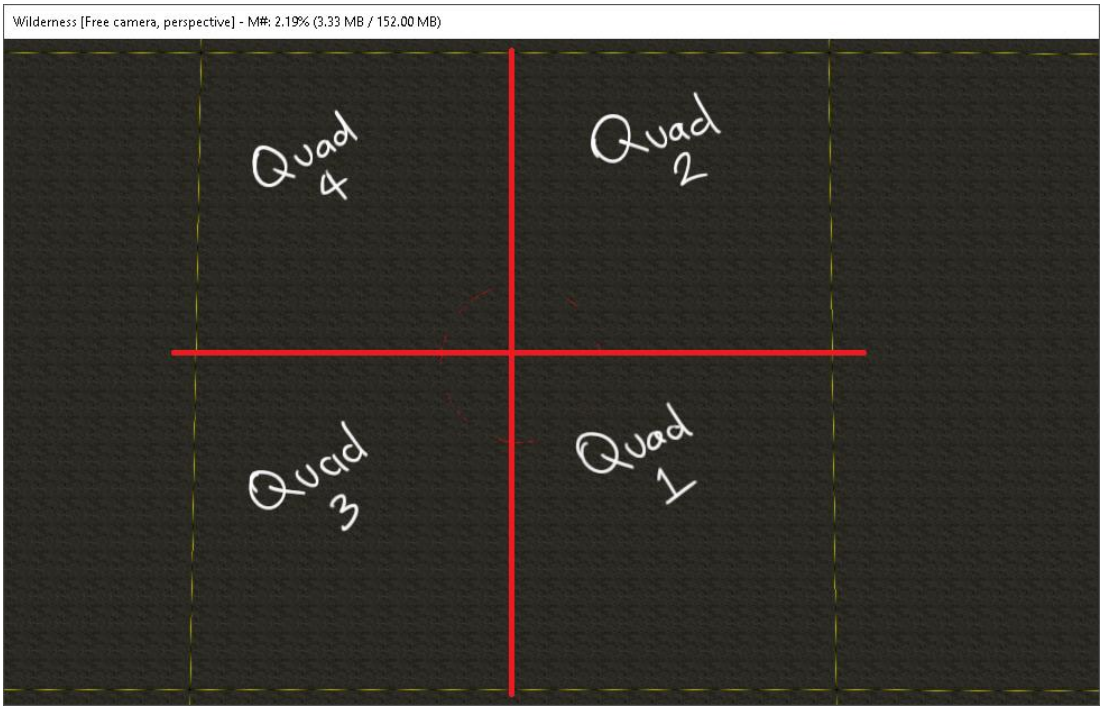

Figure 78 - Quads in a cell.

Important: Each quad can have up to **6** different textures.

Press 'I' when the landscape edit tool is active to see a list of textures that each quad of the currently loaded cell has.

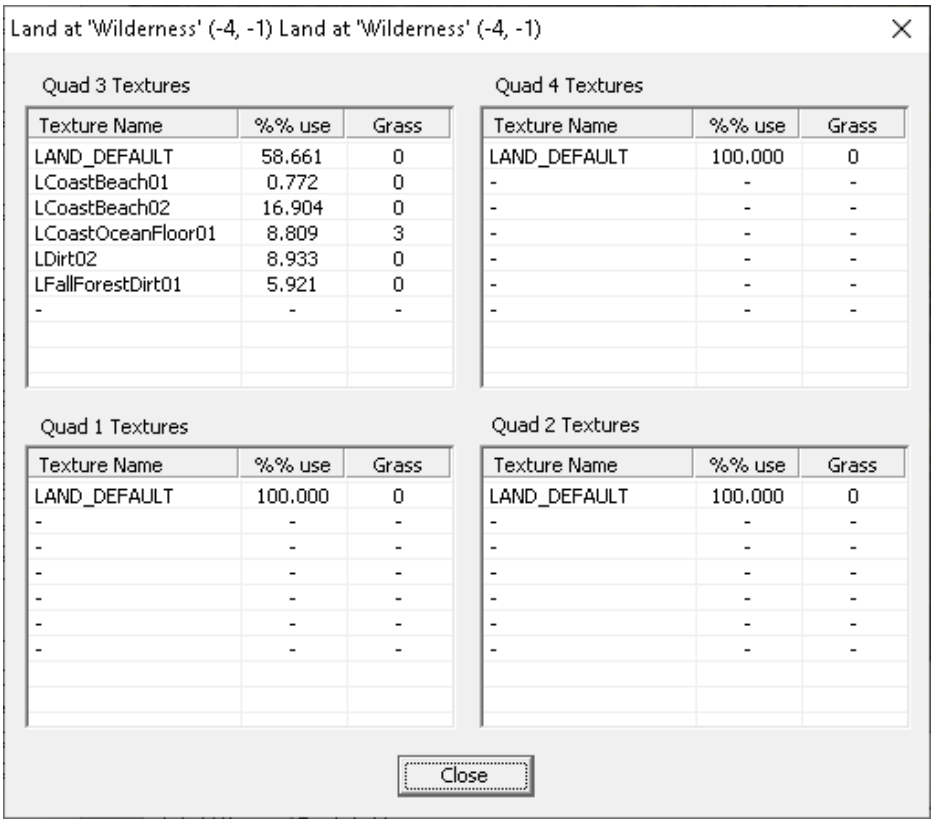

Figure 79 - Textures applied to each quad of the currently loaded cell.

In the screenshot above, you can see that I currently have the cell '-4,-1' loaded. I've been painting Quad 3 with five different textures: LCoastBeach01, LCoastBeach02, LCoastOceanFloor01, LDirt02 and LFallForestDirt01. If we include the default landscape texture, that's six separate landscape textures in quad 3.

If you try to add a seventh texture or more, you'll simply be painting with the currently selected vertex colour which by default is black. And yes I'm aware there are seven slots in the texture quad screen.

Figure 80 - Painting vertex colour.

In the example above, I tried painting with a seventh texture LFrozenMarshLichen01 in Quad 3 which resulted in a flat black texture being painted instead.

We can fix this by right-clicking on LFrozenMarshLichen01 and selecting Delete.

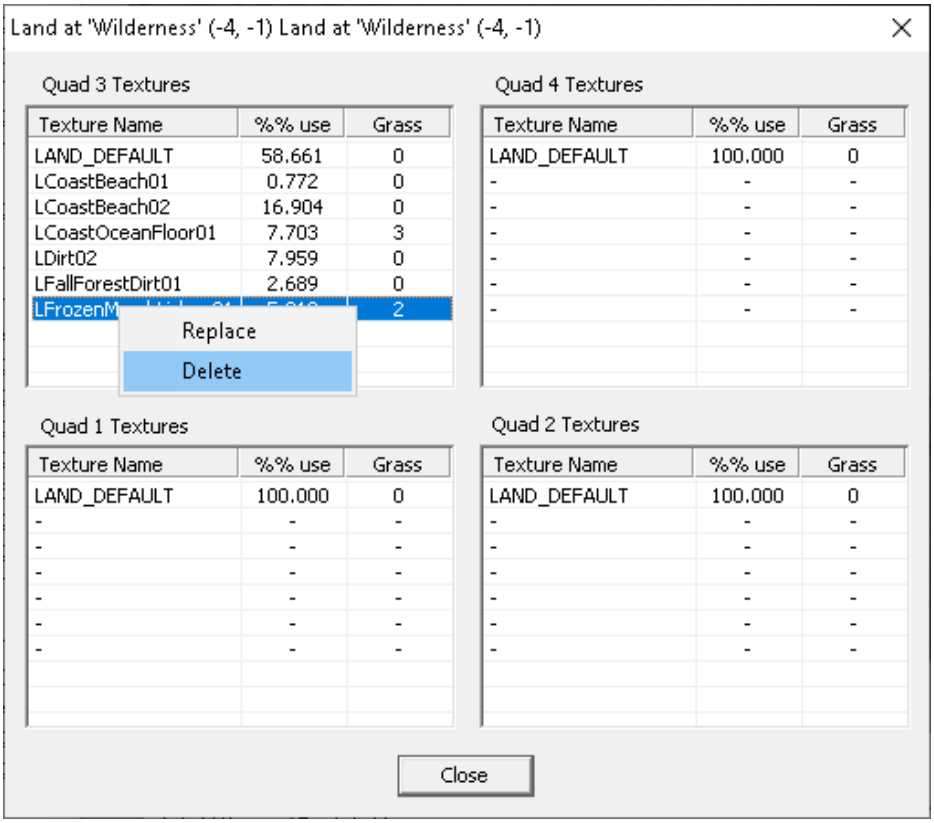

Figure 81 - Deleting the seventh texture.

Let's start painting our landscape.

In the landscape edit tool, you can select the texture you want to paint onto your landscape in the Texture list. In the following example, I'll be painting with LCoastBeach01 to paint along the coastline of our landscape.

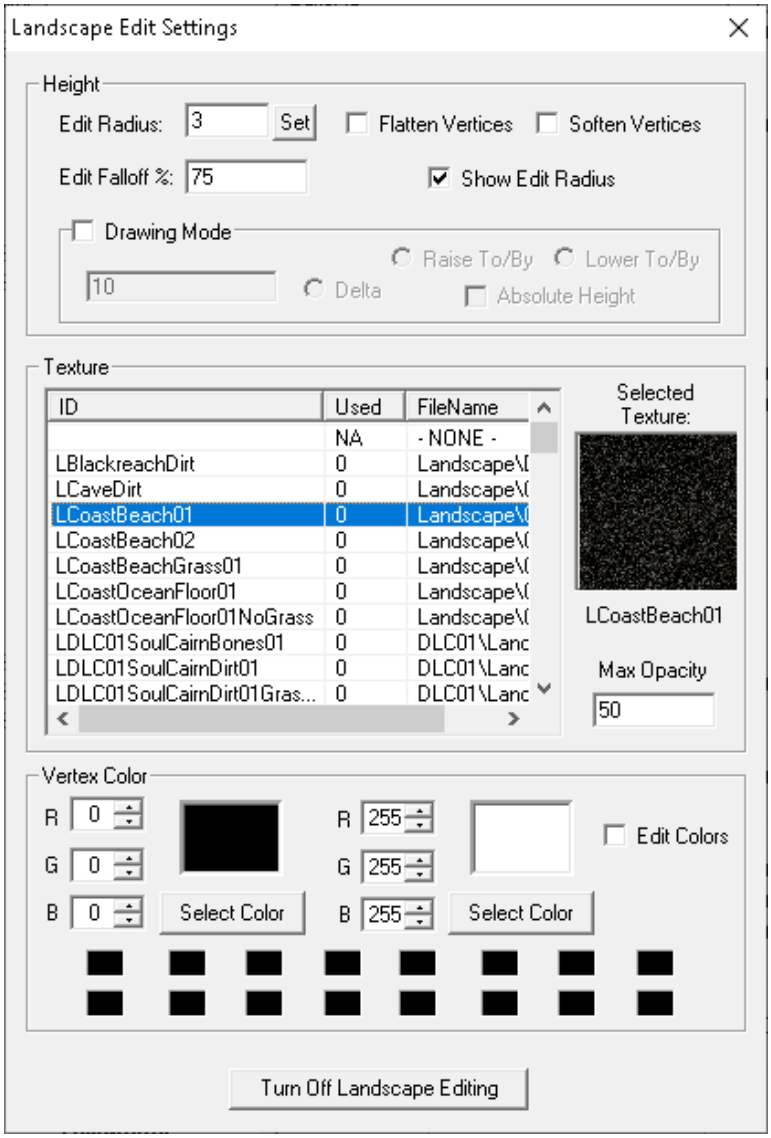

Figure 82 - Selecting our texture and reducing Max Opacity.

I also reduced the Max Opacity to 50. This will help us blend the LCoastBeach01 texture with the existing default landscape texture.

The size of your paintbrush is determined by the Edit Radius.

To erase a texture from your landscape, you can either press CTRL + Z to undo or select the blank texture shown at the top of the Texture list which acts as an eraser.

Right-click on the landscape with the landscape edit tool active to begin painting with the currently selected texture.

Remember: Left-click to sculpt, right-click to paint.

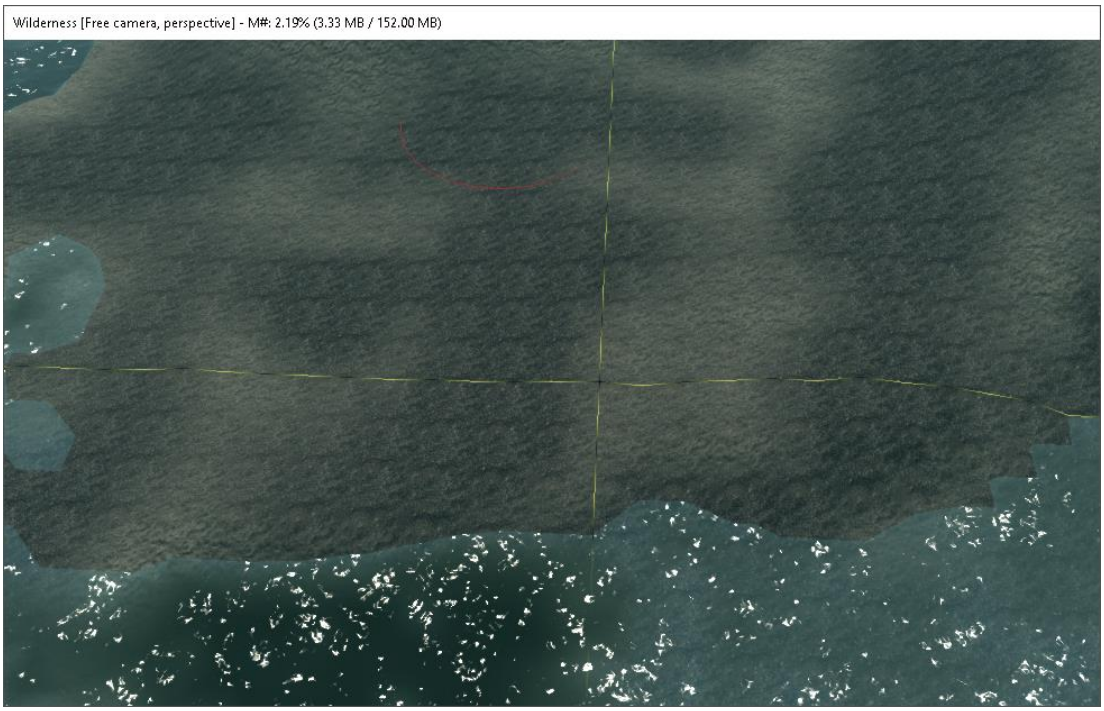

Figure 83 - Painting LCoastBeach01 around the coastline.

Rather than painting the landscape uniformly, I like to right-click here and there to try and blend the textures together in a kind of splotchy manner.

In the following screenshot, I painted a section of the coastline with a single texture, and as you can see, the tiling pattern of the texture that I used is glaringly obvious.

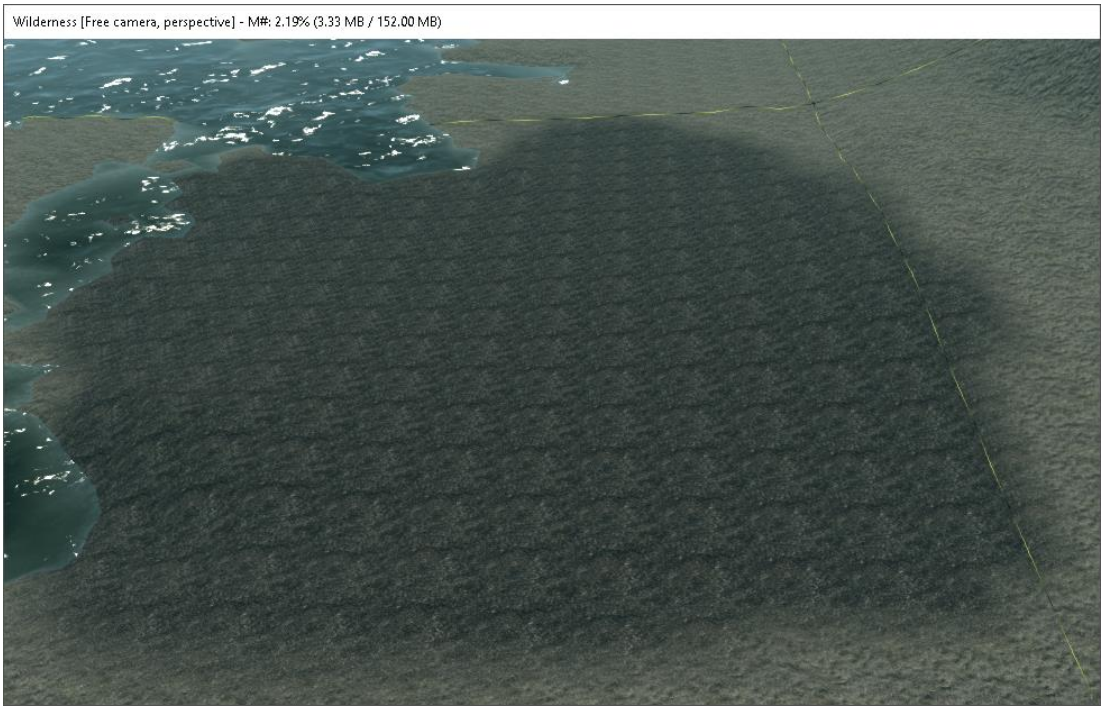

Figure 84 - Texture tiling.

But we can use other textures to help break up that repeating pattern.

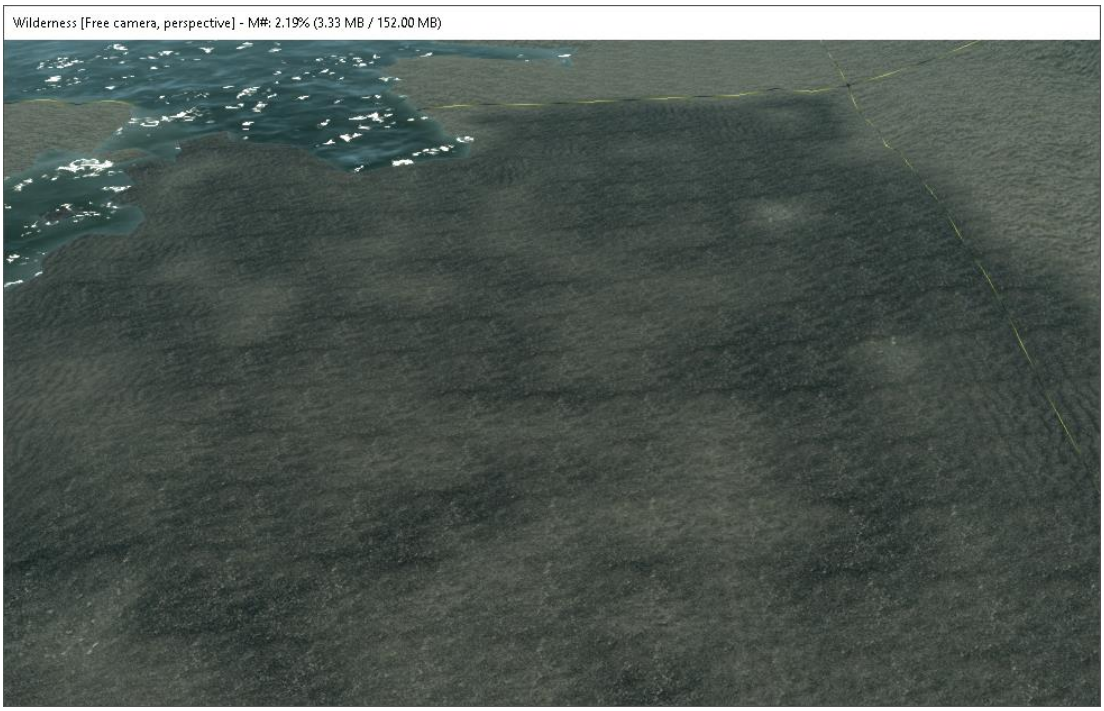

Figure 85 - Breaking up texture tiling.

Some textures such as LCoastBeachGrass01 or LRocks01 will also add grass or small rocks to your landscape and will further help hide that tiling effect.

Figure 86 - Adding textures with grass and rocks.

If you chose the wrong texture, you can replace a texture in a quad by right-clicking on it and choosing Replace.

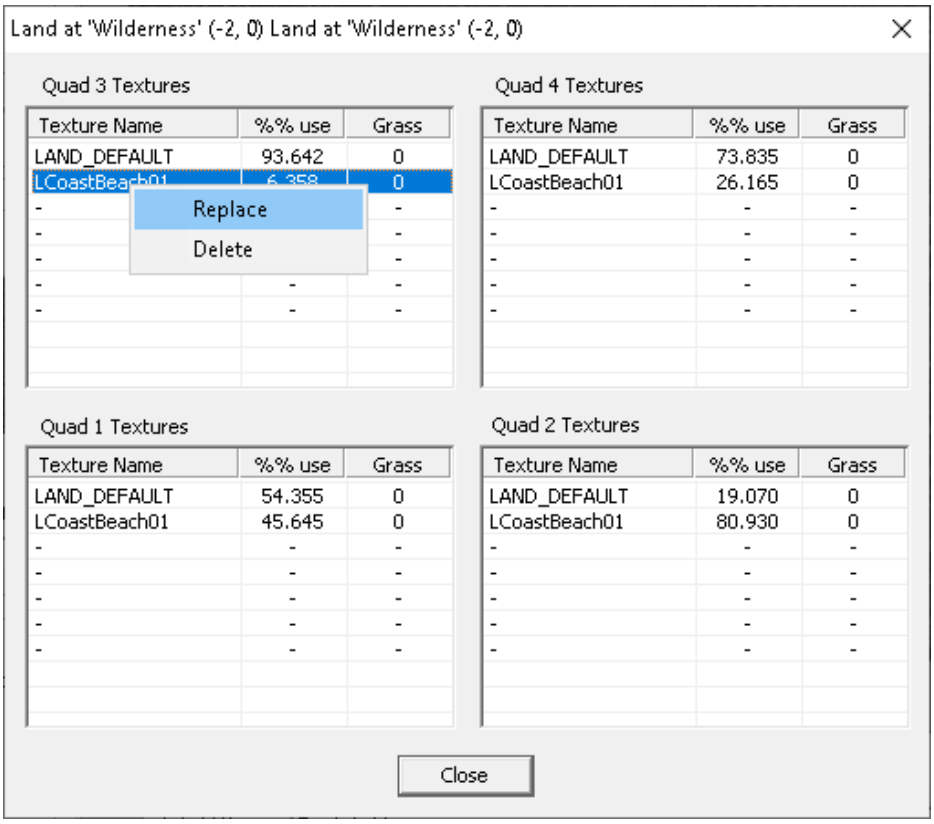

Figure 87 - Replacing a texture in a quad.

In the Select Form pop-up, choose the texture you want instead and click OK.

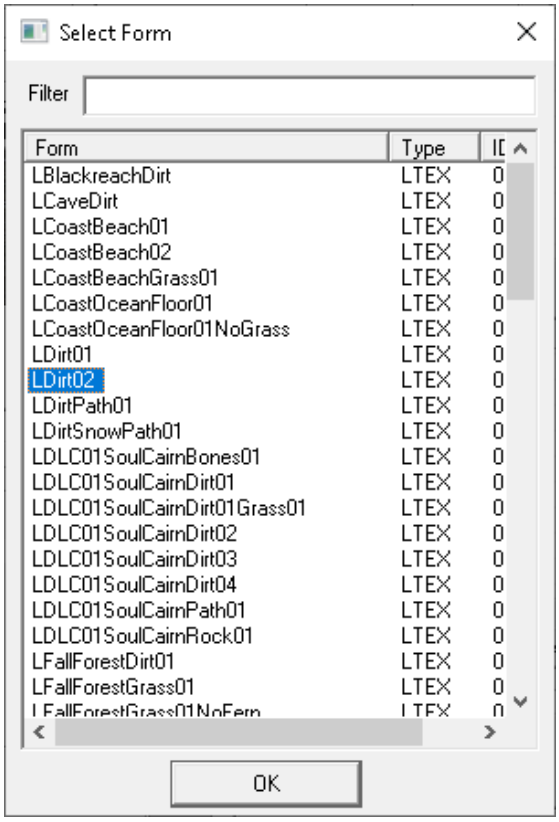

Figure 88 - Choosing the texture we want to replace LCoastBeach01 with.

When replacing textures, just be aware that you may create a texture seam, like the one in the screenshot below along the edge of the quad if you replaced the texture in one quad but not the other.

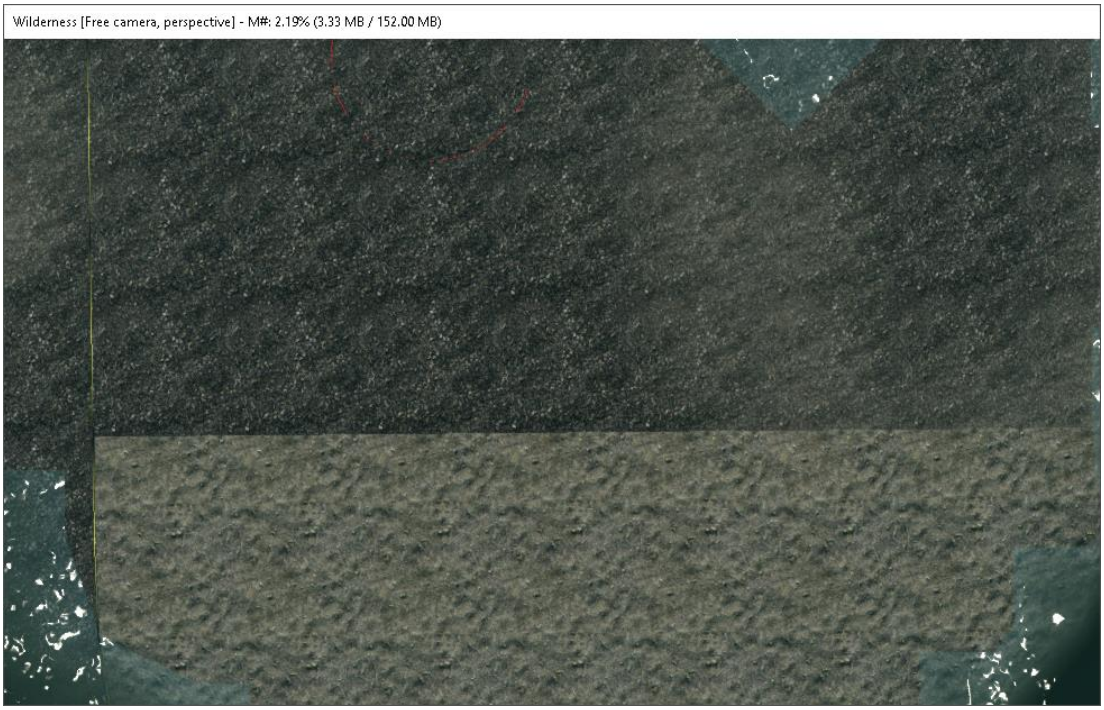

Figure 89 - A texture seam caused by replacing or deleting a texture.

CREATING TILEABLE LANDSCAPE TEXTURES

In this section I'll be showing you how to create your own tileable terrain textures that you can paint onto your landscape. I'll be using Photoshop CS5 in my example.

Note: For Photoshop you will need the NVIDIA Texture Tools Plugin which is available on the NVIDIA website.

Firstly, we'll need a source image. For this example, I just went to Google Images and searched for 'dirt', limiting my search results to images under a Creative Commons license.

The image below is free for commercial use with no attribution requirements.

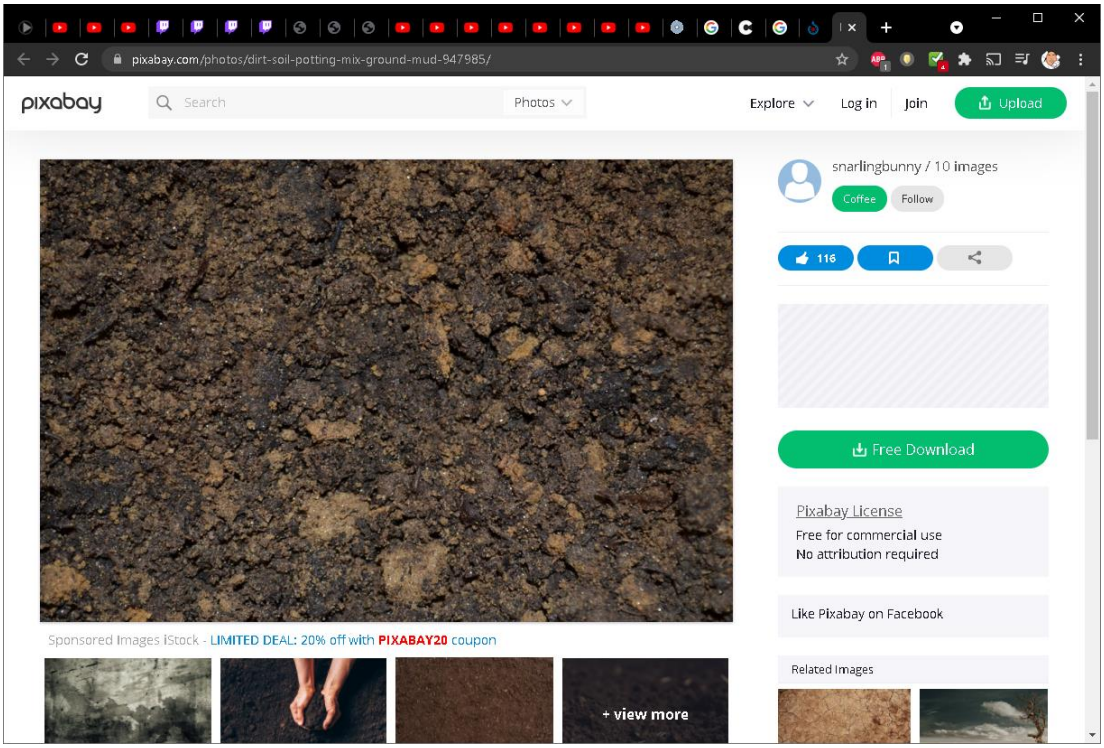

Figure 90 - Source dirt texture.

In Photoshop, go to File > New.

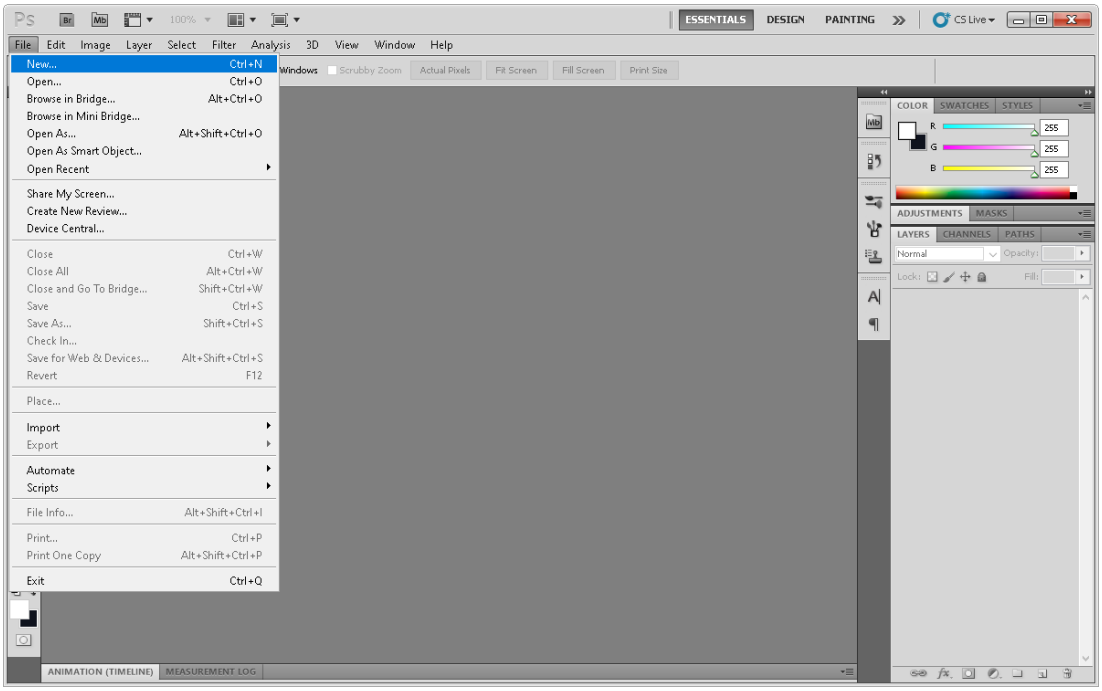

Figure 91 - Creating a new image file in Photoshop.

For the sake of this example, I'm going to create a new 512x512 texture which is the same size as the default landscape textures in Skyrim. If you want to make it bigger that's up to you, just make sure to double the size, e.g.: 1024x1024, 2048x2048, and so on.

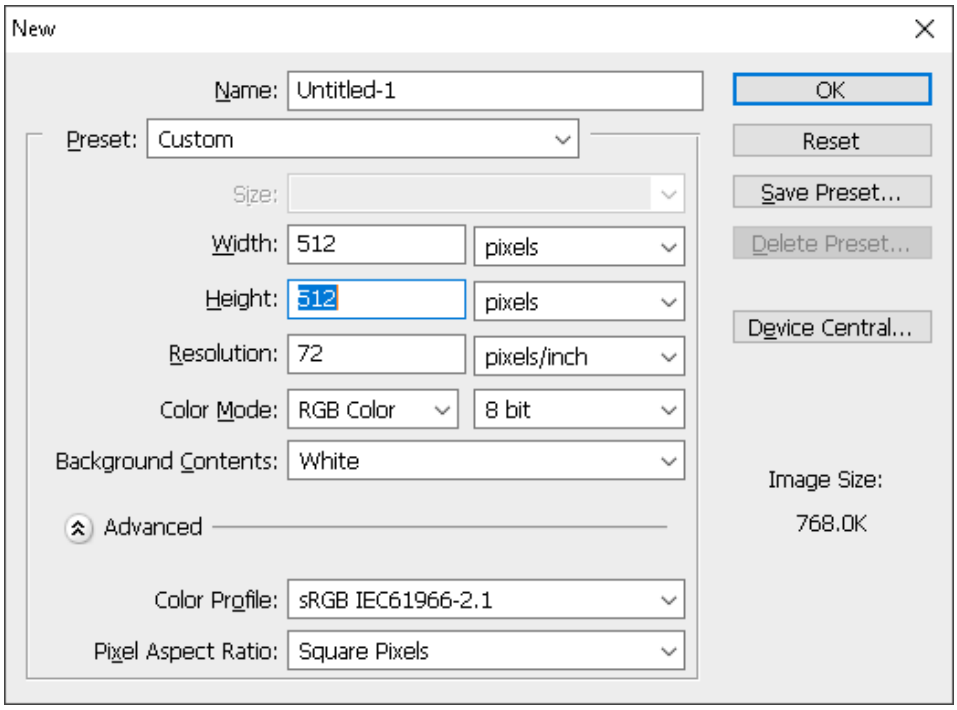

Figure 92 - Size of new image.

Click OK to create a new blank document.

Drag and drop your texture into Photoshop and expand it to fill the height and width of the canvas.

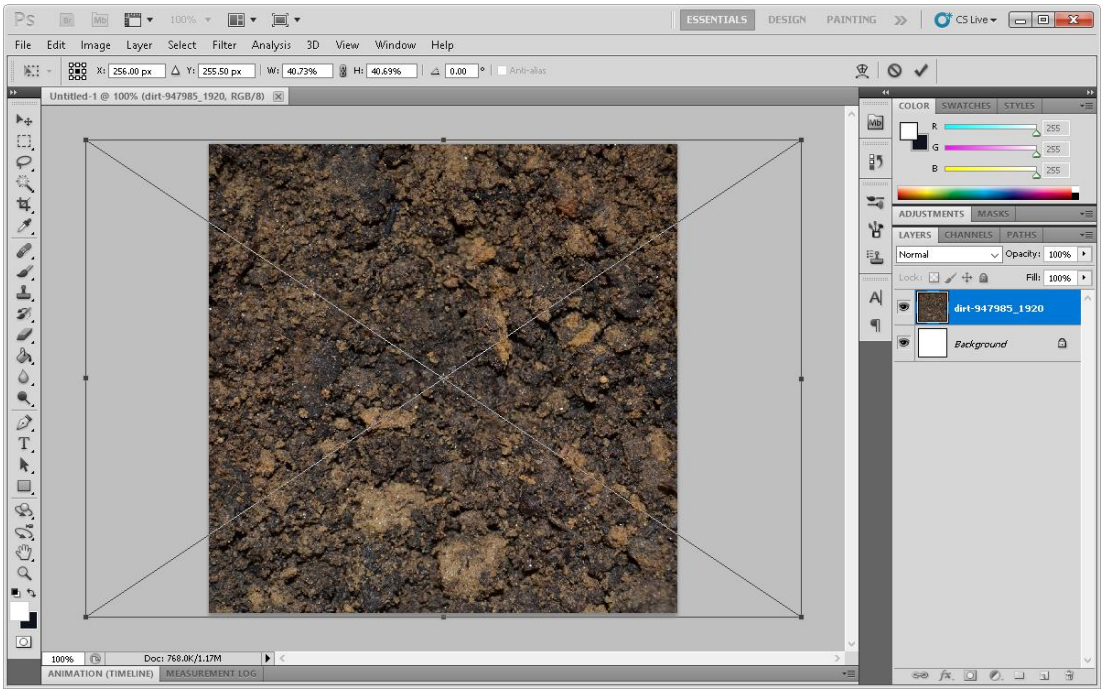

Figure 93 - Importing the source image.

I made some adjustments to the image, mostly out of personal taste. I desaturated the texture, reduced its brightness, shifted the hue slightly to make it less red, then ran a sharpen filter. The idea was basically to try and make it match the existing landscape textures in the base game which are all fairly dark and desaturated.

Don't worry, our texture will look a lot lighter in-game in day time lighting.

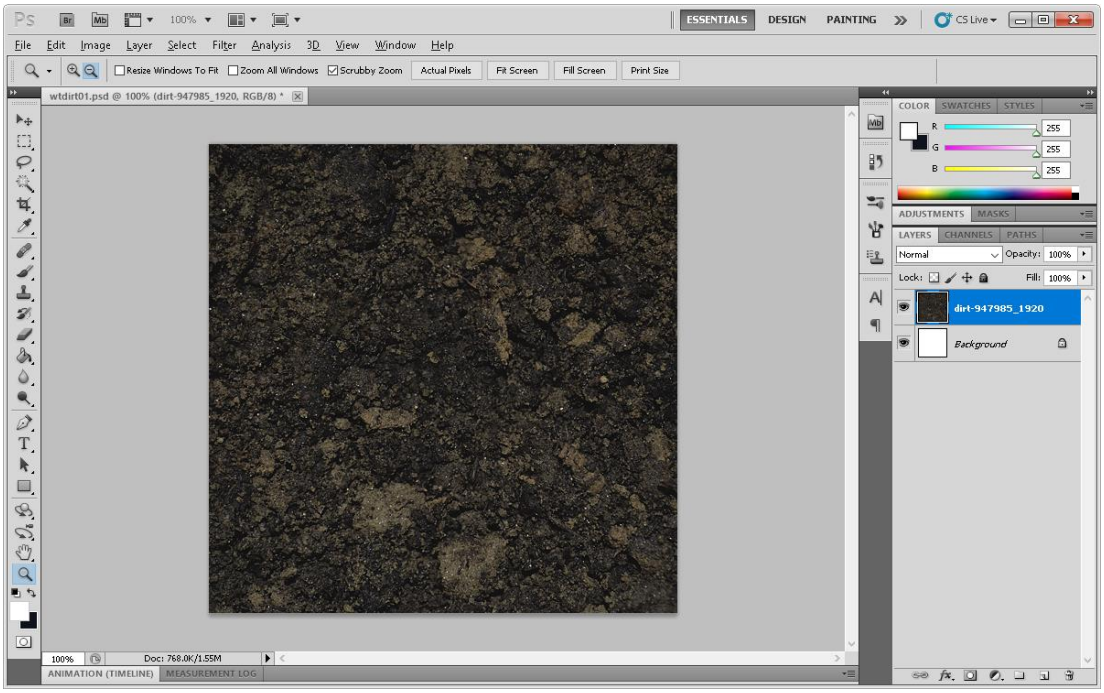

Figure 94 - Dirt image after some adjustments.

Now to make the image tileable.

Go to Filter > Other > Offset and change the Horizontal offset until the vertical texture seam is roughly in the middle of the image.

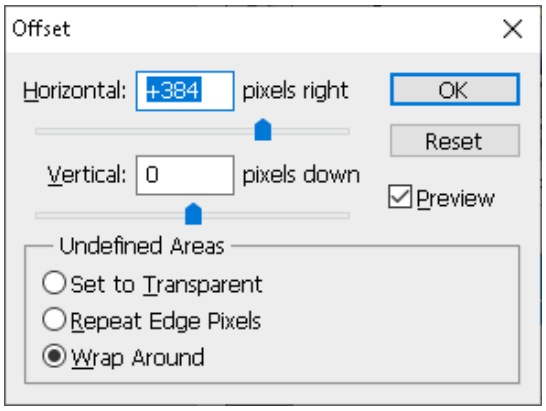

Figure 95 - Changing the horizontal texture offset.

Ensure Undefined Areas is set to Wrap Around then click OK.

In the screenshot below you can see the vertical texture seam running down the centre of the image.

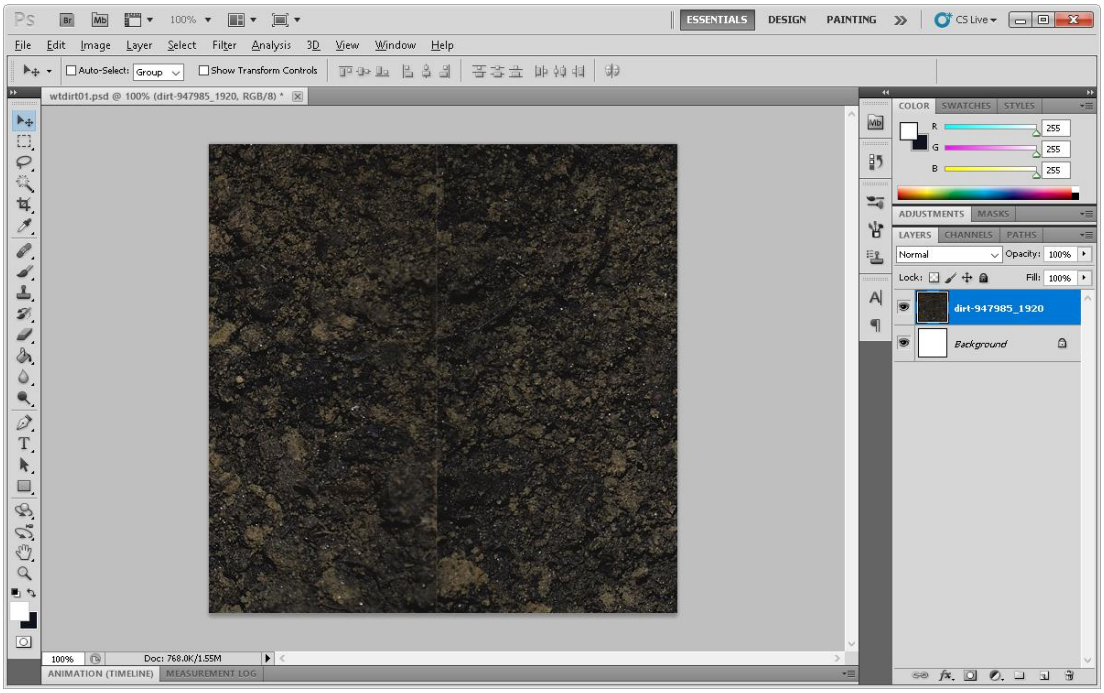

Figure 96 - Vertical texture seam.

Use the Healing Brush to remove the seam. If you hold down ALT your cursor will change into a crosshair. ALT left-click on a part of the image away from the seam to sample that part of the image, then left-click over the seam to begin replacing it with the part of the image you sampled.

In the following screenshot, the vertical seam has been removed.

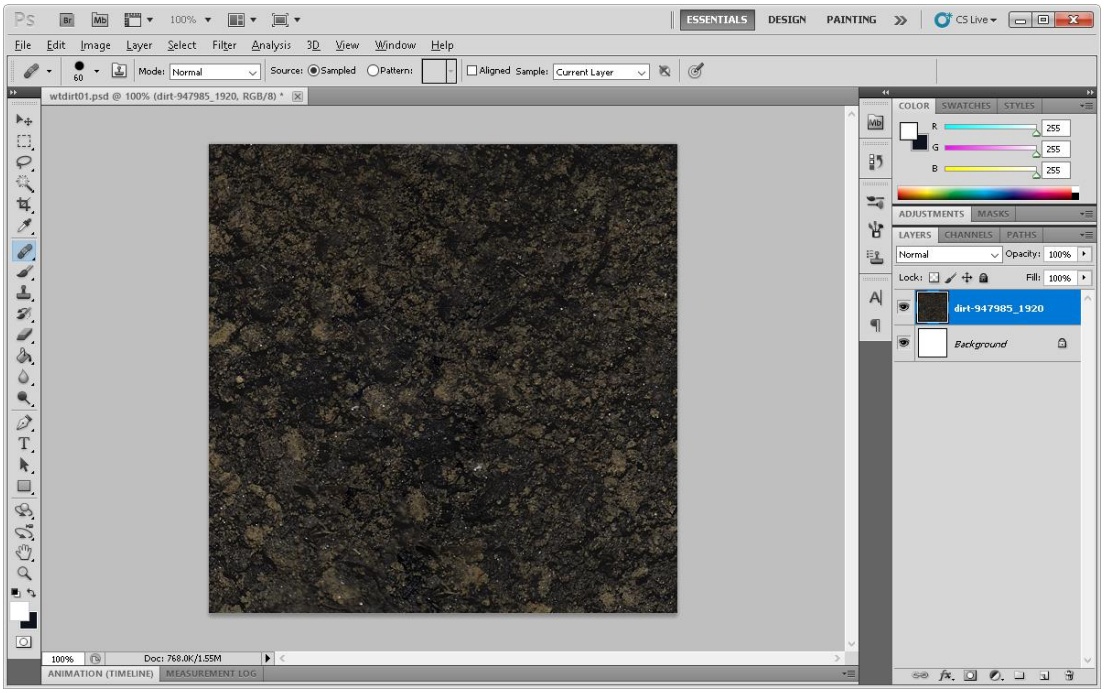

Figure 97 - Vertical seam removed.

Go back to Filter > Other > Offset.

This time, set a Vertical offset. Make sure the Horizontal offset is set back to 0 first.

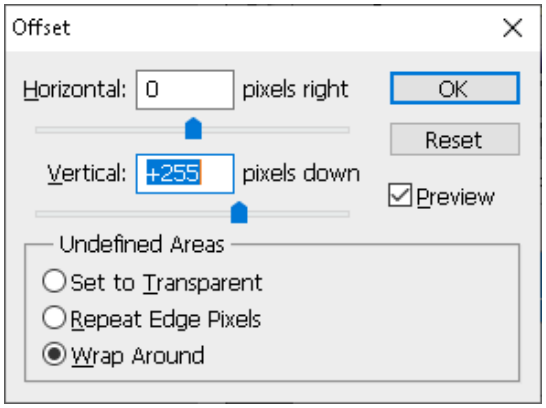

Figure 98 - Setting a vertical offset.

Again, make sure Undefined Areas is set to Wrap Around, then click OK.

You should now see a horizontal seam running across the image.

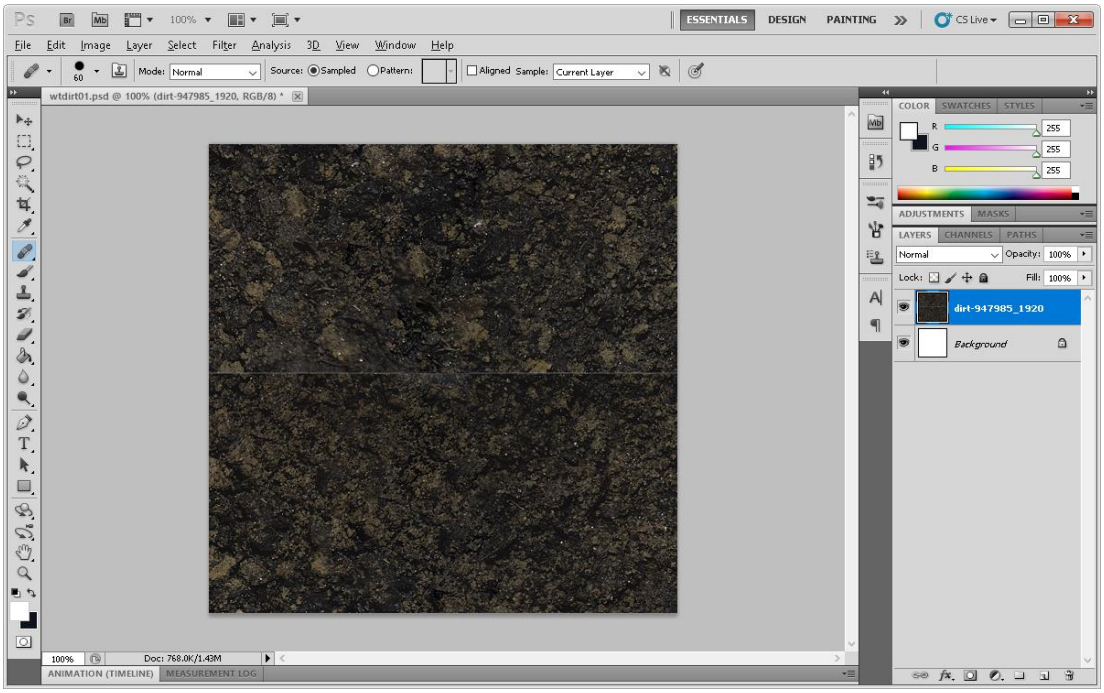

Figure 99 - Horizontal seam.

Use the Healing Brush tool to remove it in the same way you removed the vertical seam earlier.

Again, go back to Filter > Other > Offset.

This time, change both the Vertical and Horizontal offsets and just make sure no more seams are visible. If there are, use the Healing Brush tool to remove them.

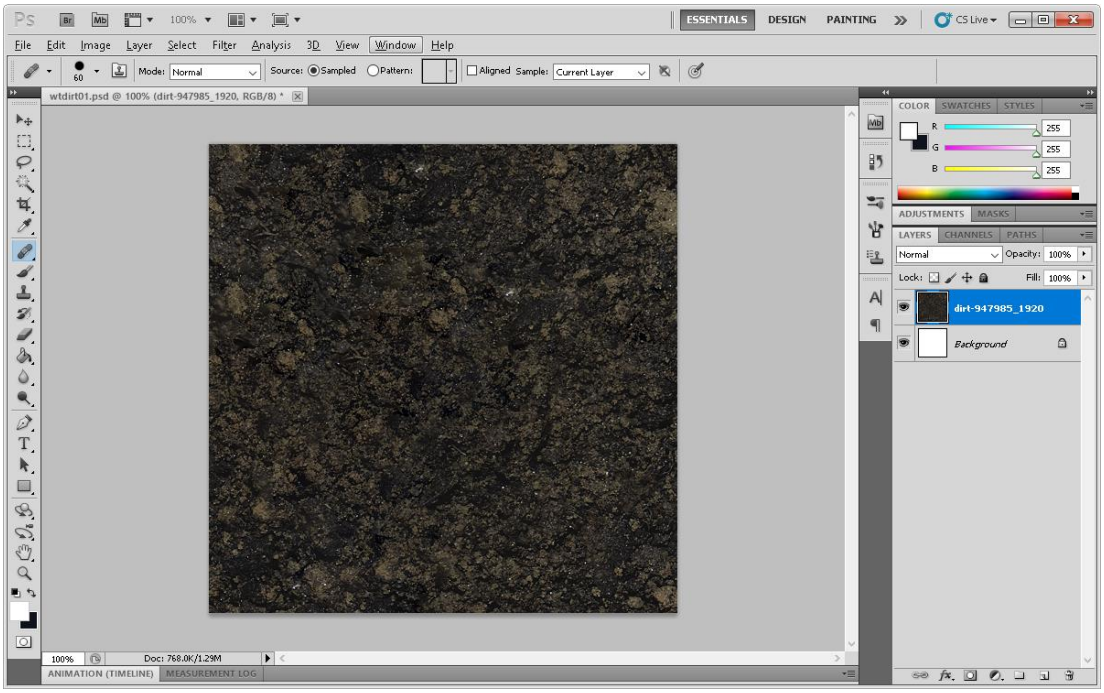

Figure 100 - Making sure there are no more seams.

Alright, our diffuse map is done. Time to export the image as a .dds file.

Go to File > Save As.

Set the Format to 'D3D/DDS' and choose a location to save the .dds file to.

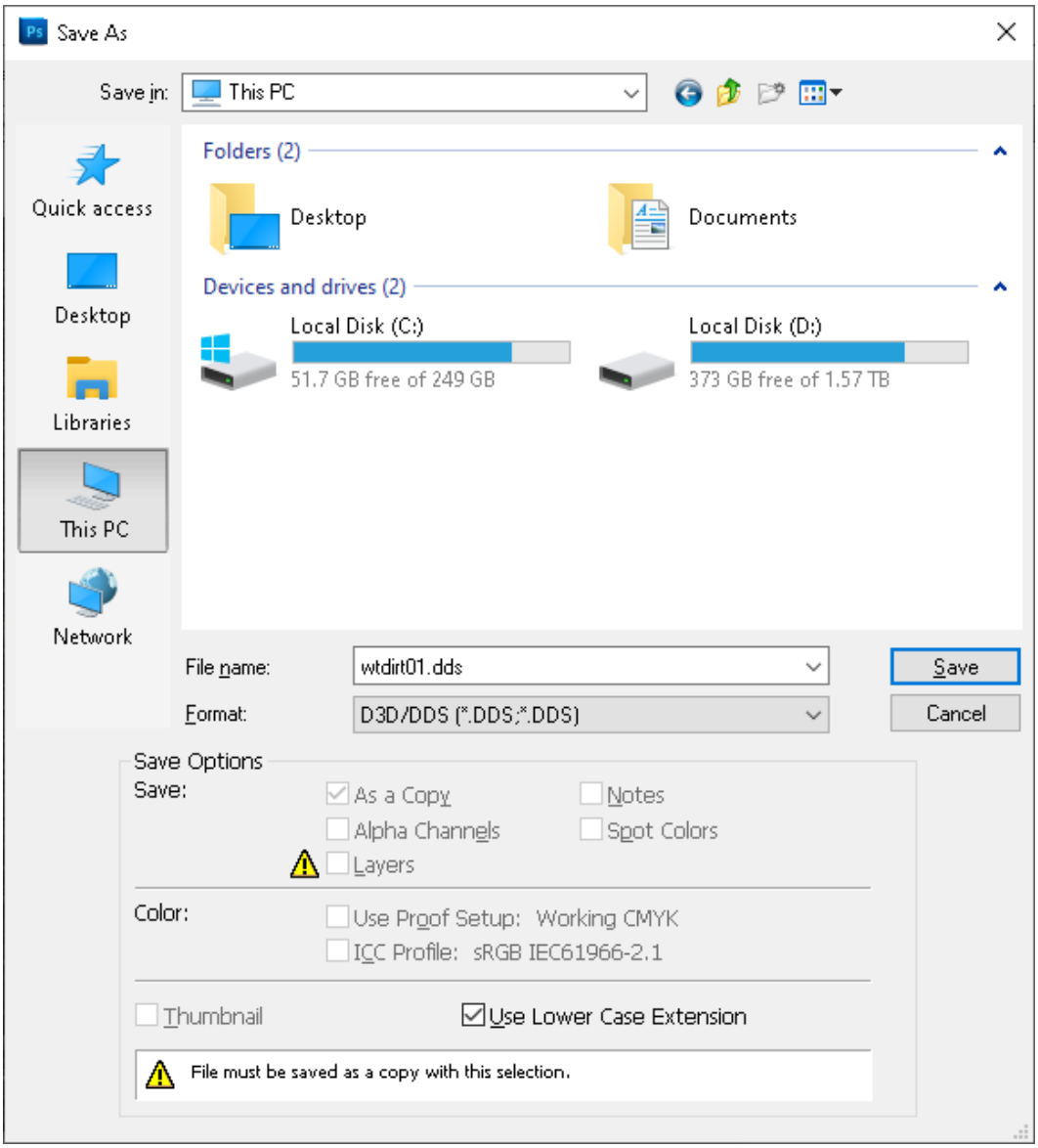

Figure 101 - Saving our file as a .dds file.

Set the .dds format to DXT5. Make sure MIP Map Generation is set to 'Generate MIP Maps' then click Save.

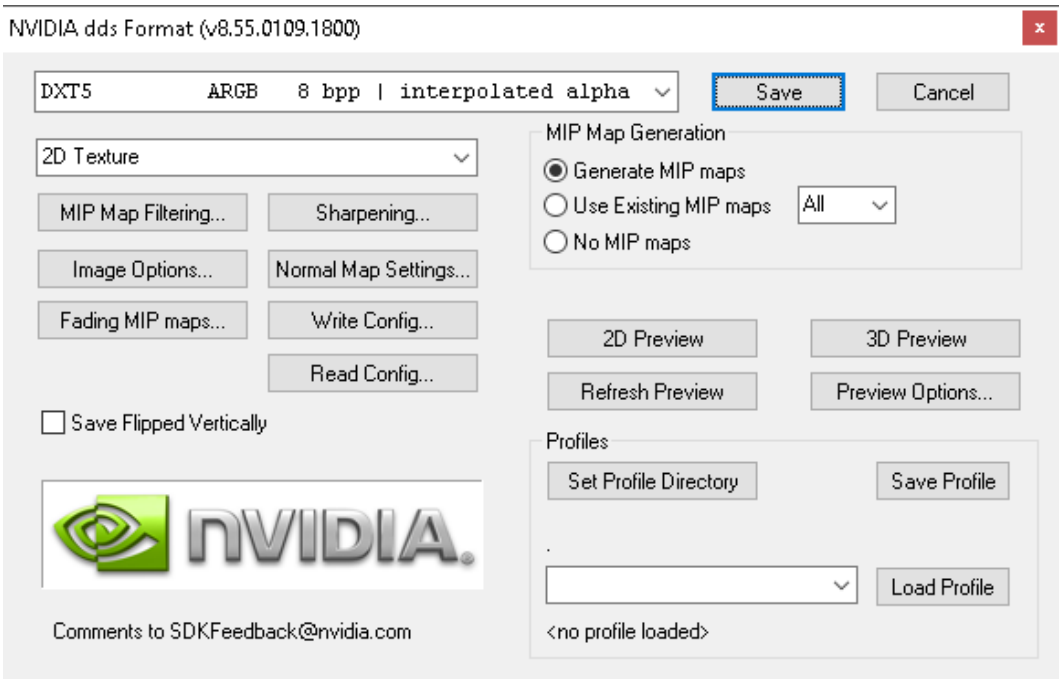

Figure 102 - NVIDIA Texture Tools Plugin.

Next, we need to create a normal map for our texture. For this, I'm going to use the njob utility.

Launch njob, go to File > Open and select your .dds texture file.

Figure 103 - Our texture loaded in njob.

The first thing we need to do is convert our image into a height map. Go to Filter and select Diffusemap > Heightmap or press '0'.

What you set the sliders to is up to your personal preference, but to try and bring out more granular detail I'm going to reduce the Scale and Coarse Detail sliders.

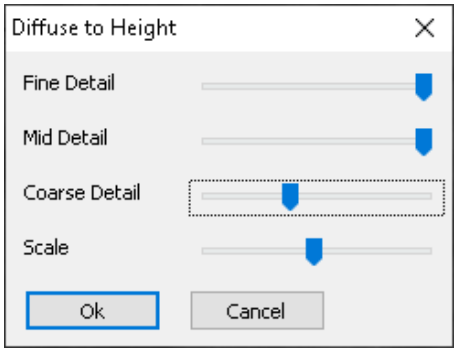

Figure 104 - Diffuse to Height.

We should now have a black and white image similar to the following screenshot.

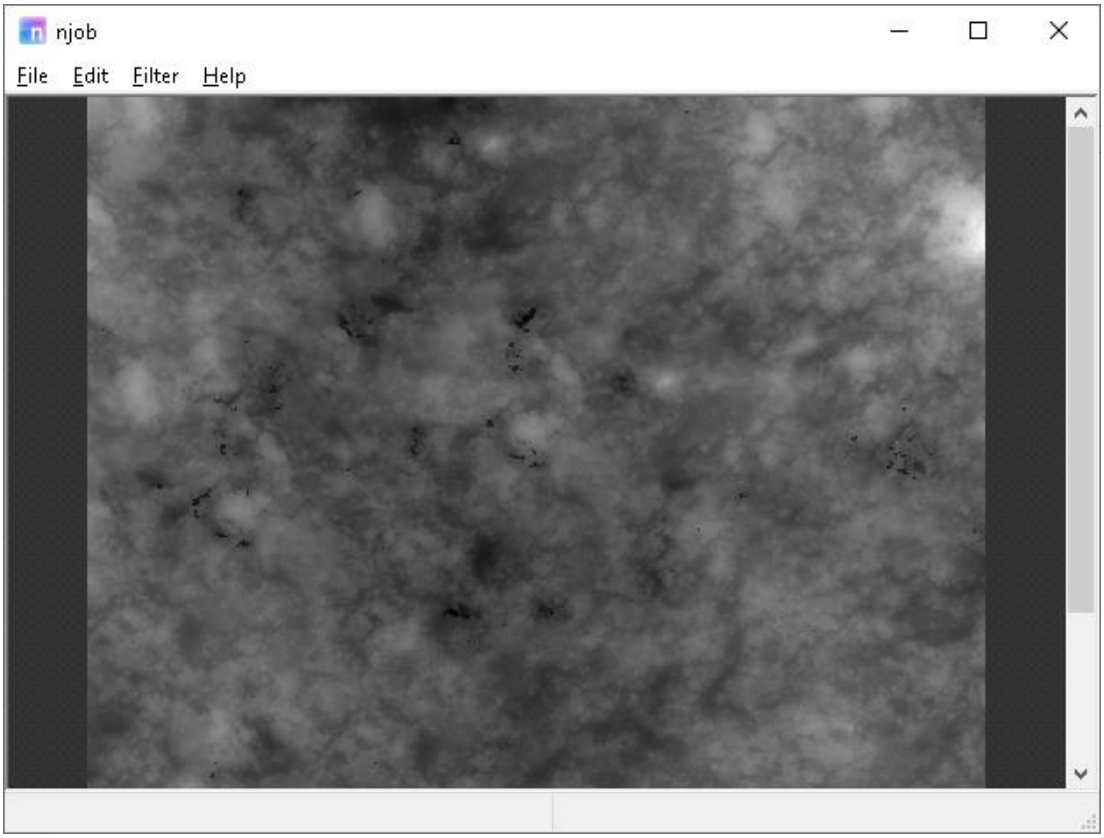

Figure 105 - Our texture converted into a height map.

Now we need to convert this to a normal map.

Go to Filter and choose Heightmap > Normalmap.

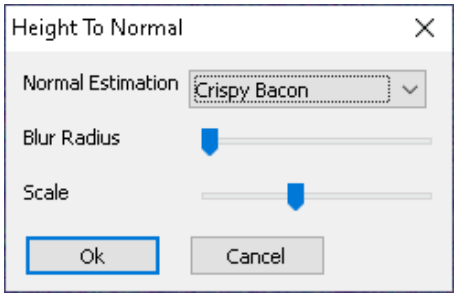

Figure 106 - Height to Normal.

I would recommend changing the Normal Estimation to 'Crispy Bacon' and increase the Scale slider a bit for a closer approximation to the normal maps used by default Skyrim landscape textures. If you take a look at the normal maps of existing textures, they all look pretty sharp.

Click OK.

Now we have our normal map.

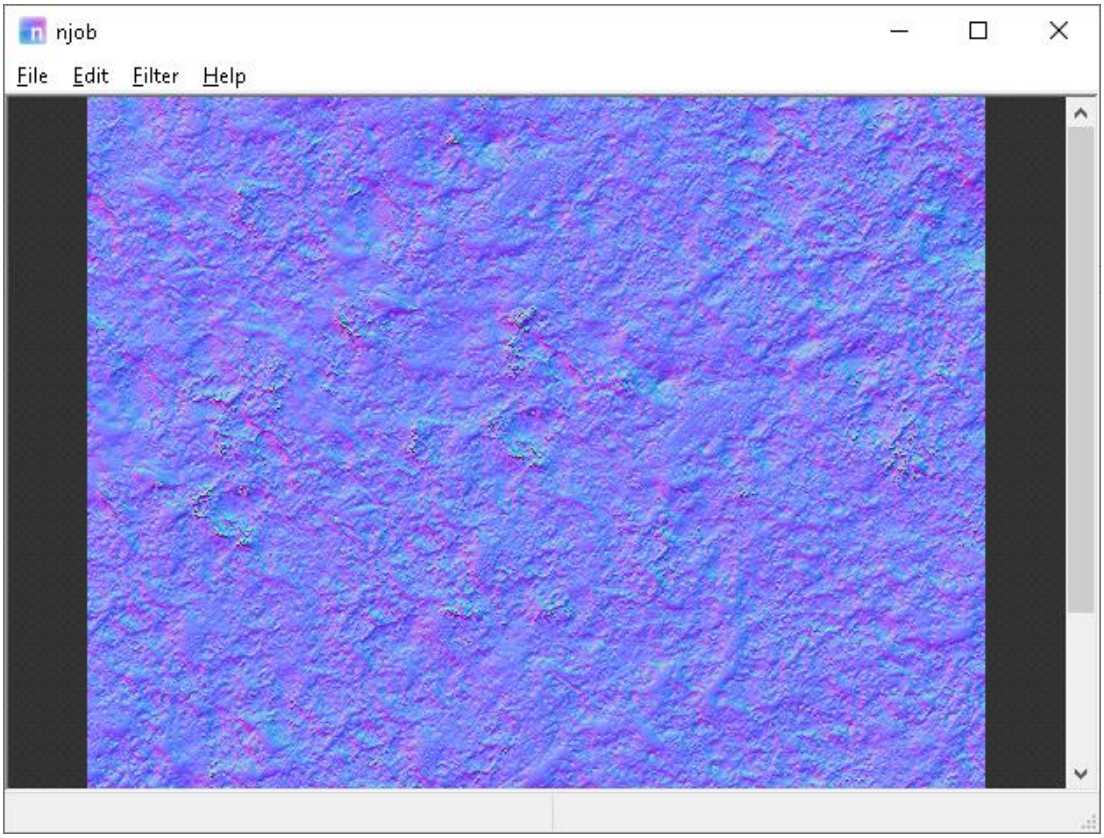

Figure 107 - Normal map for the new landscape texture.

To export it, go to File > Save As.

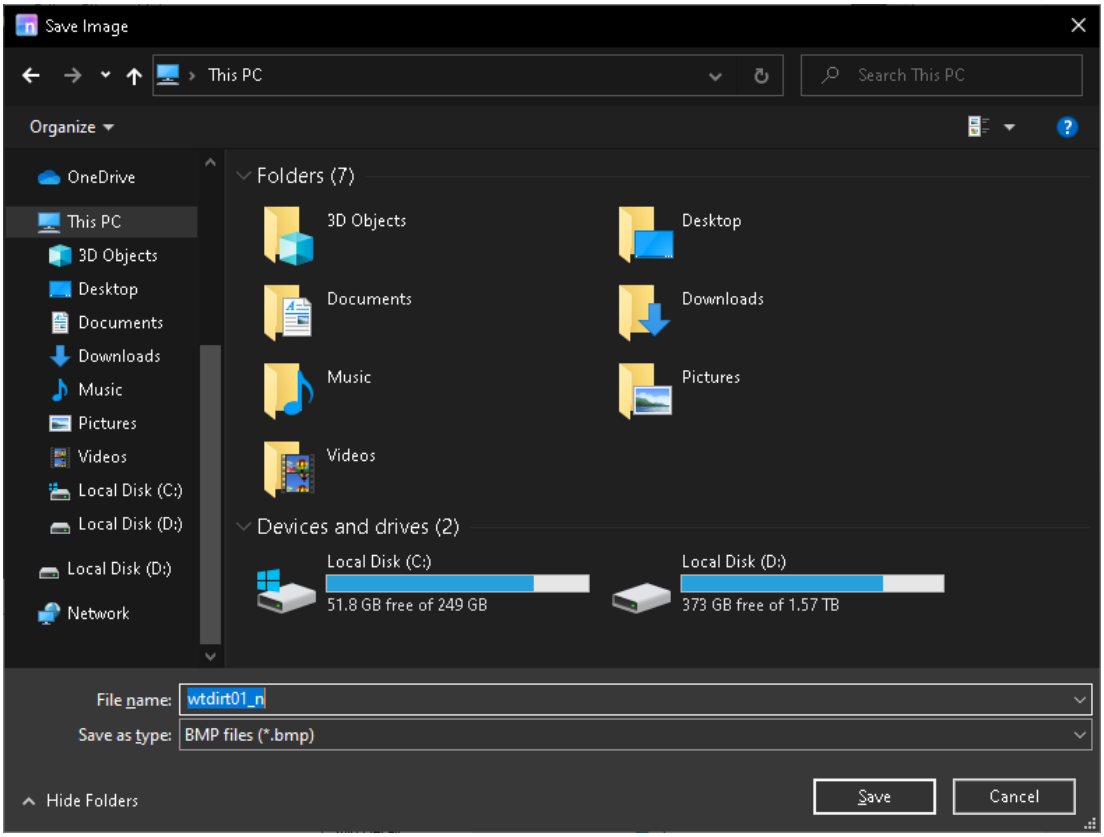

Figure 108 - Saving our normal map.

Choose a location to save to. njob can't save files in the .dds format so we're going to have to save our image as a bitmap for now. Normal map textures in Skyrim have '_n' appended to the end of the file name so don't forget to add that as well.

Click Save.

Time to convert that bitmap to .dds format.

Open the normal map in Photoshop.

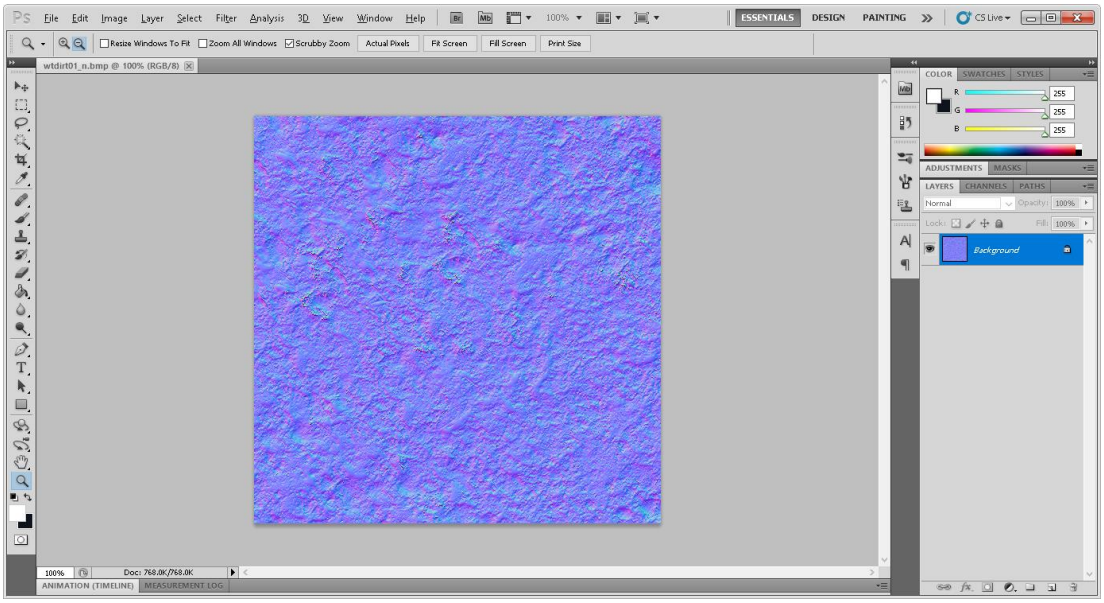

Figure 109 - Our normal map in Photoshop.

Go to File > Save As.

Choose a location to save the .dds file to.

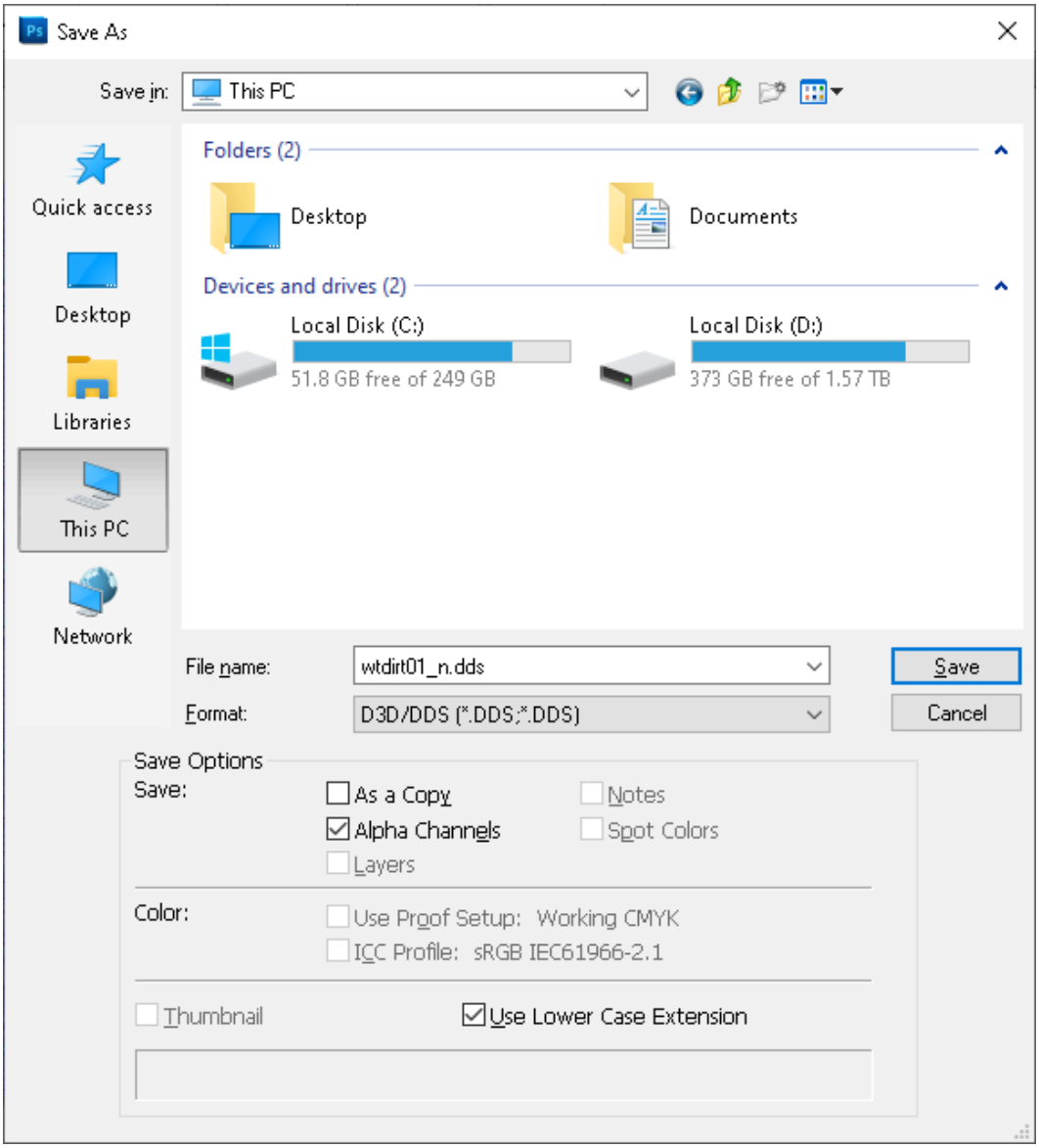

Figure 110 - Saving our normal map as a .dds file.

Set the .dds format to DXT5. Make sure MIP Map Generation is set to 'Generate MIP Maps' then click Save.

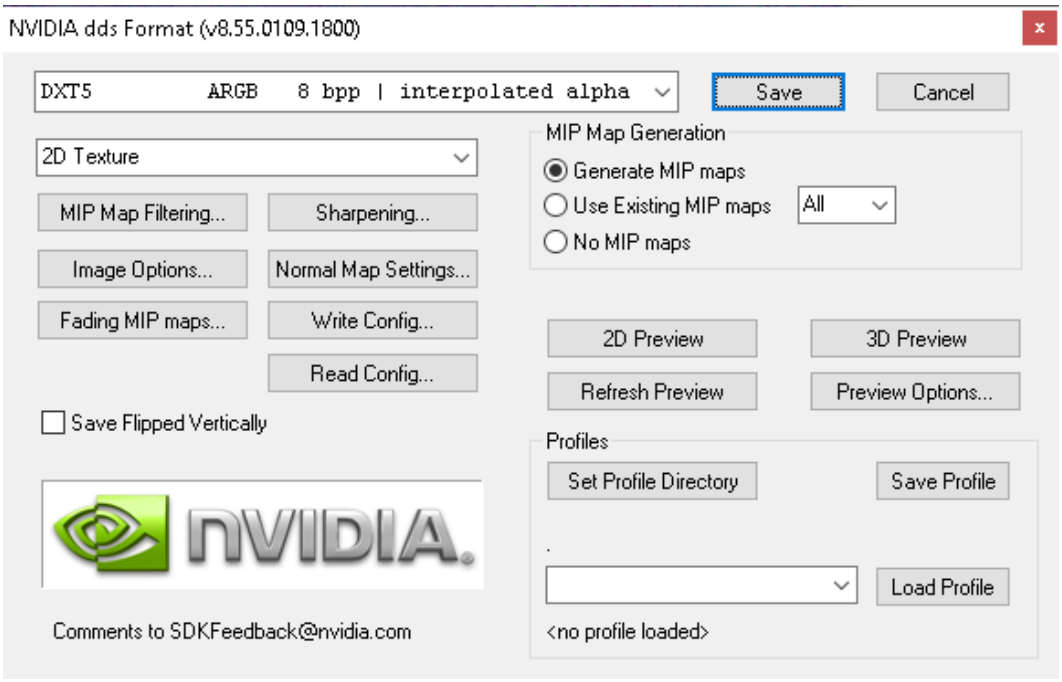

Figure 111 - NVIDIA Texture Tools Plugin.

Copy your diffuse texture and its normal map to the 'Skyrim\Data\Textures\landscape' folder. If the Textures or Landscape folders don't exist under Data, create them first.

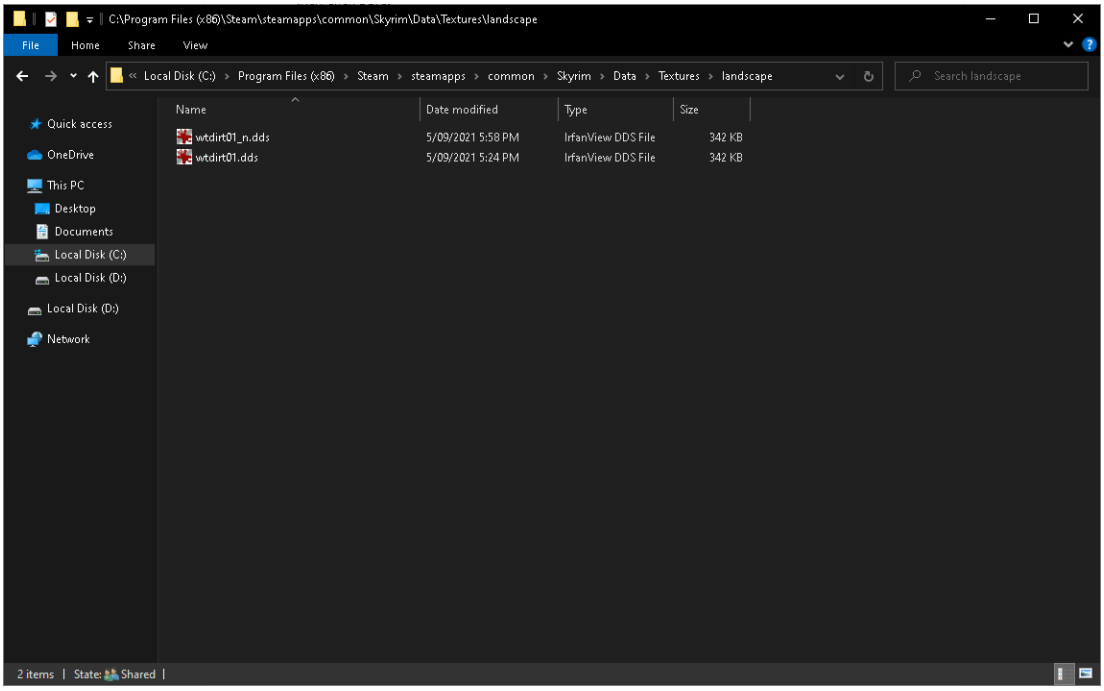

Figure 112 - Our files in copied to the correct directory.

Alright, we're almost there.

Back in the Creation Kit, in the Object Window go to Miscellaneous > TextureSet.

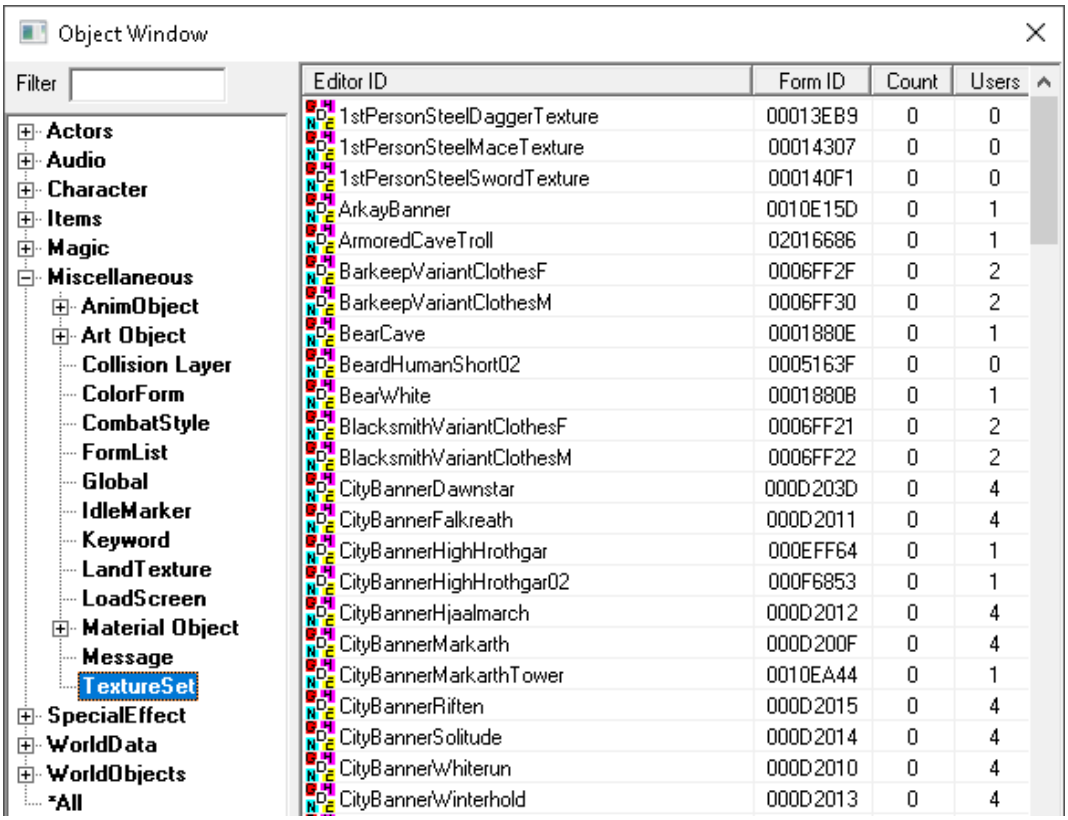

Figure 113 - Texture sets.

Right-click on one of the existing texture sets and select New.

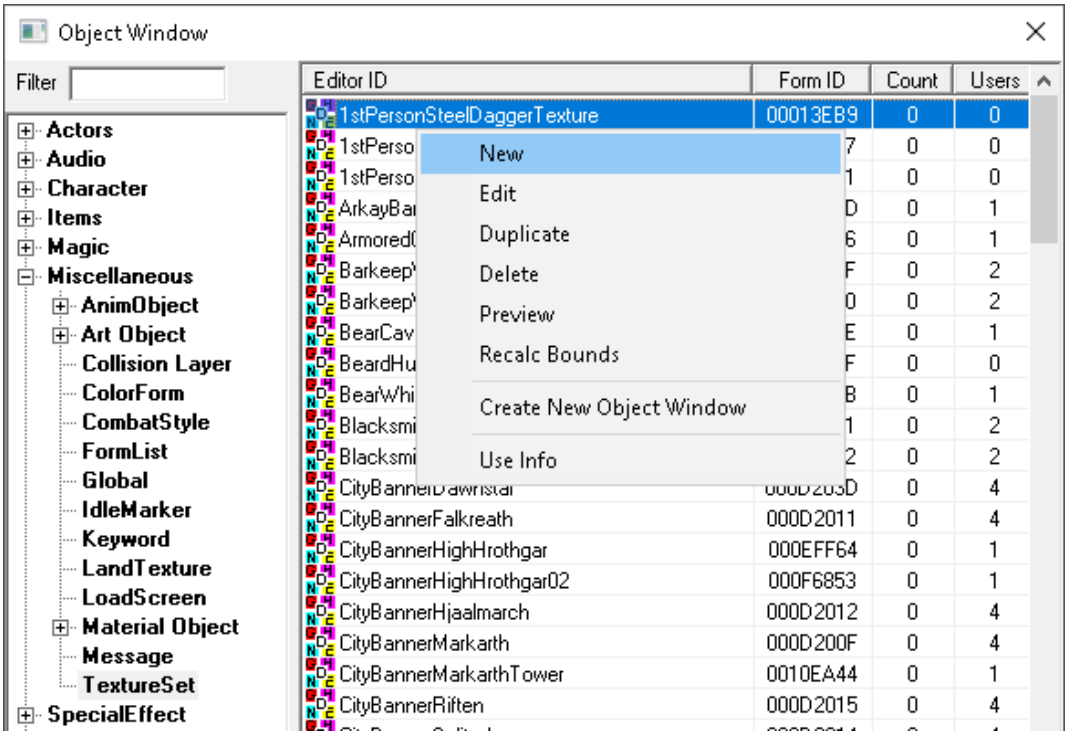

Figure 114 - Creating a new texture set.

Enter in a name for your texture set. In this example, I just called it LandscapeDirt01 and added the 'WT' prefix.

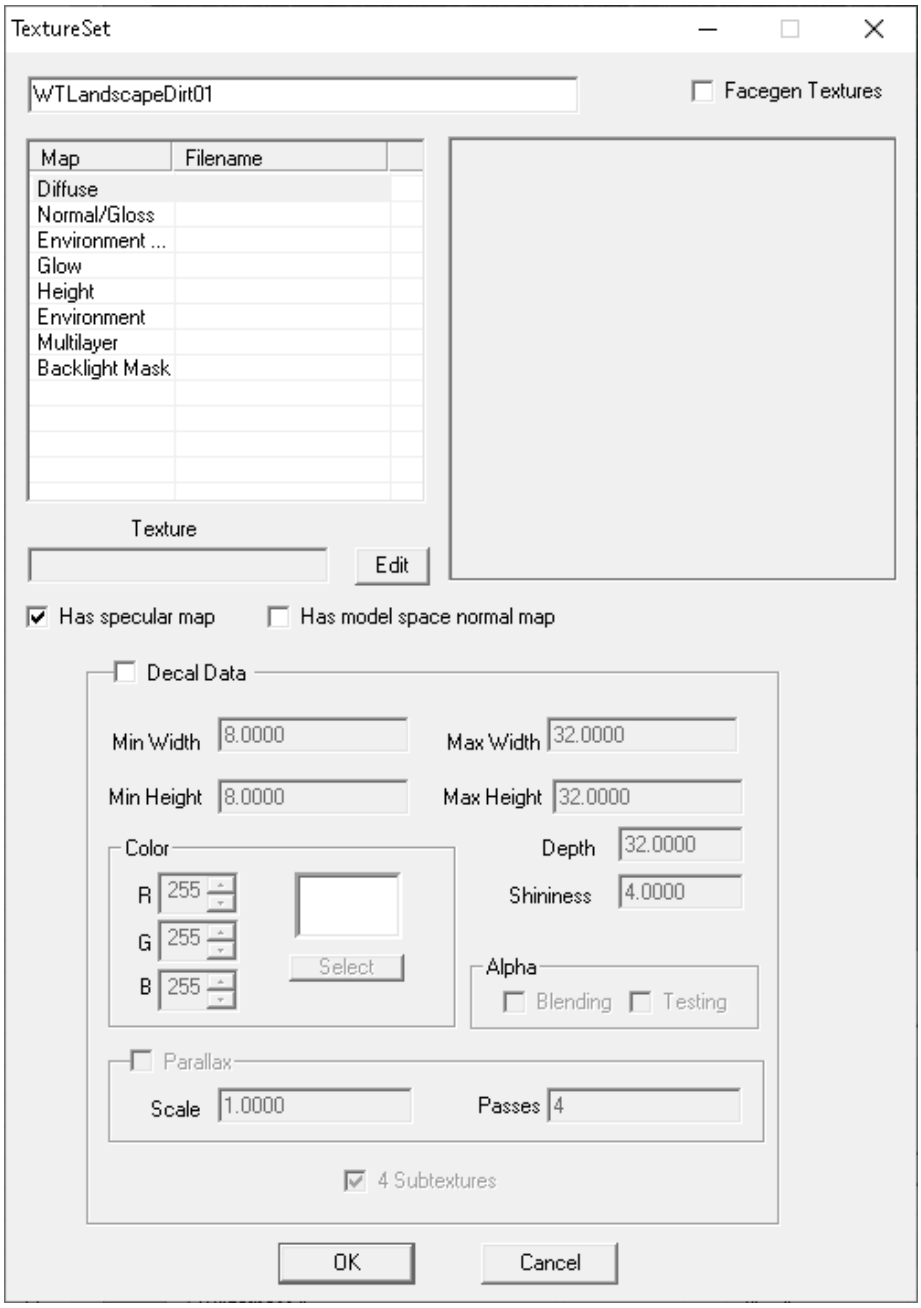

Figure 115 - Naming the new texture set.

Click on Diffuse then click on the Edit button to the right of Texture.

Select your diffuse map located under 'Skyrim\Data\Textures\landscape' and click Open.

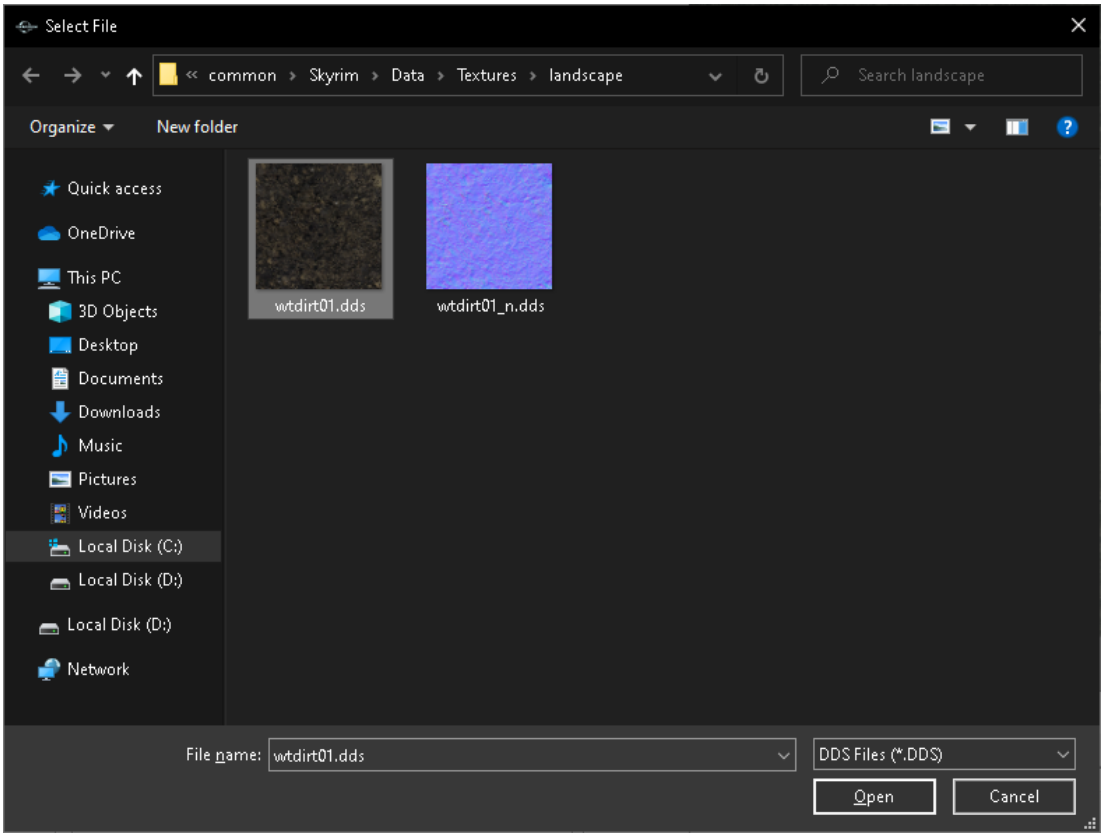

Figure 116 - Diffuse map selected.

Repeat those steps to add your normal map to Normal/Gloss.

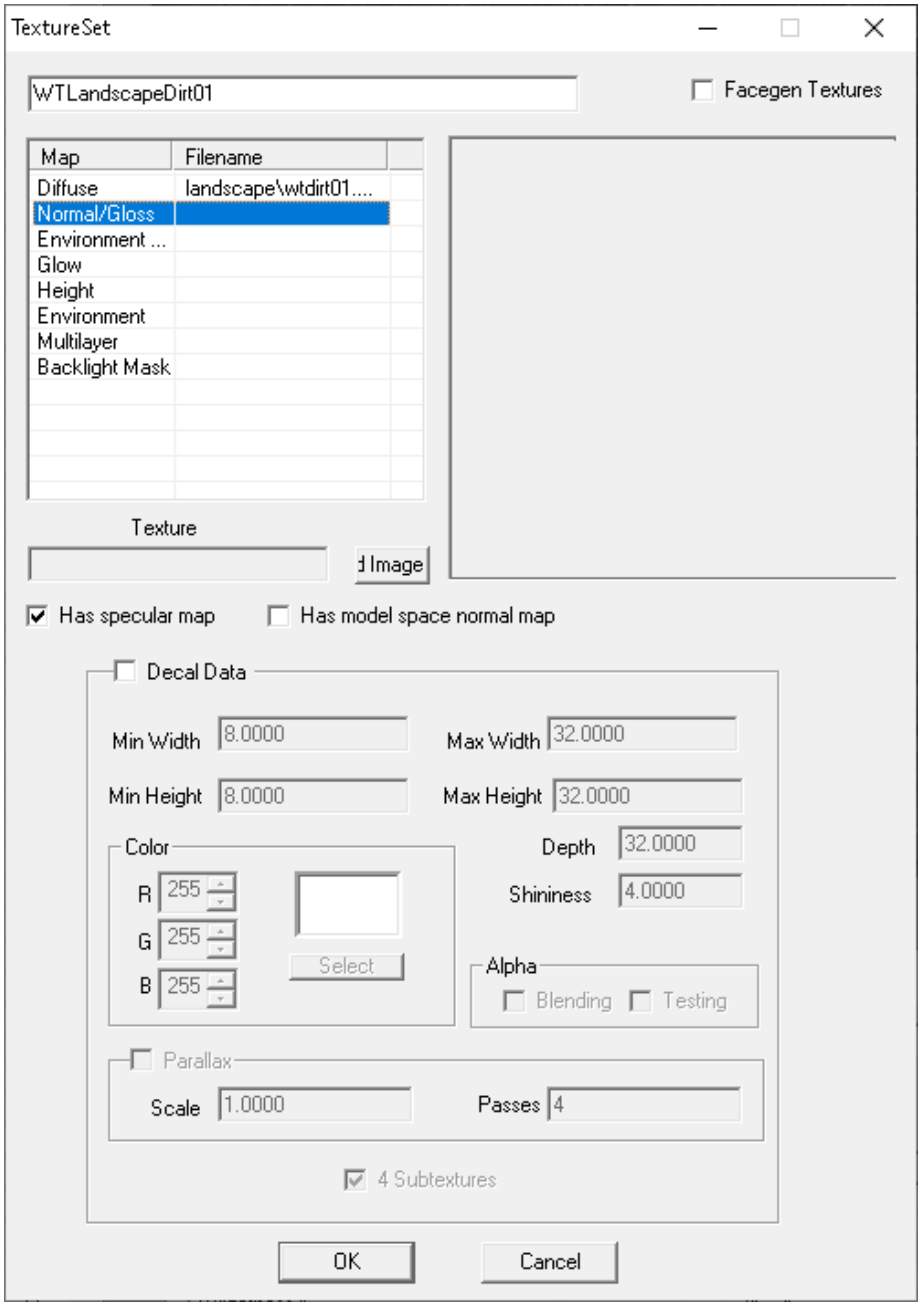

Figure 117 - Diffuse map added.

You should now have a diffuse and normal map added to the texture set as per the screenshot below.

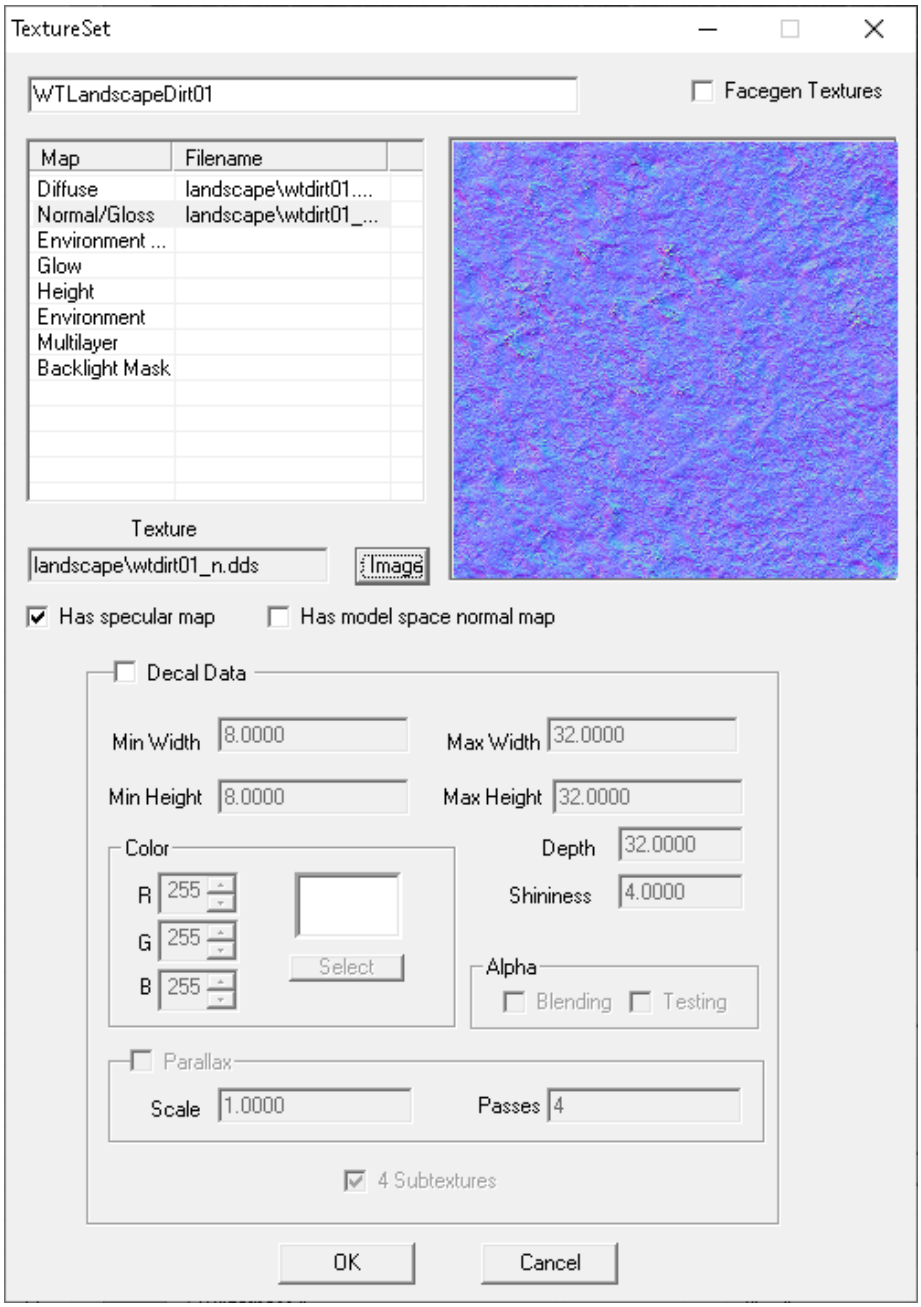

Figure 118 - Both diffuse and normal maps added.

Click OK to close out of the TextureSet properties.

Back in Object Window go to Miscellaneous > LandTexture.

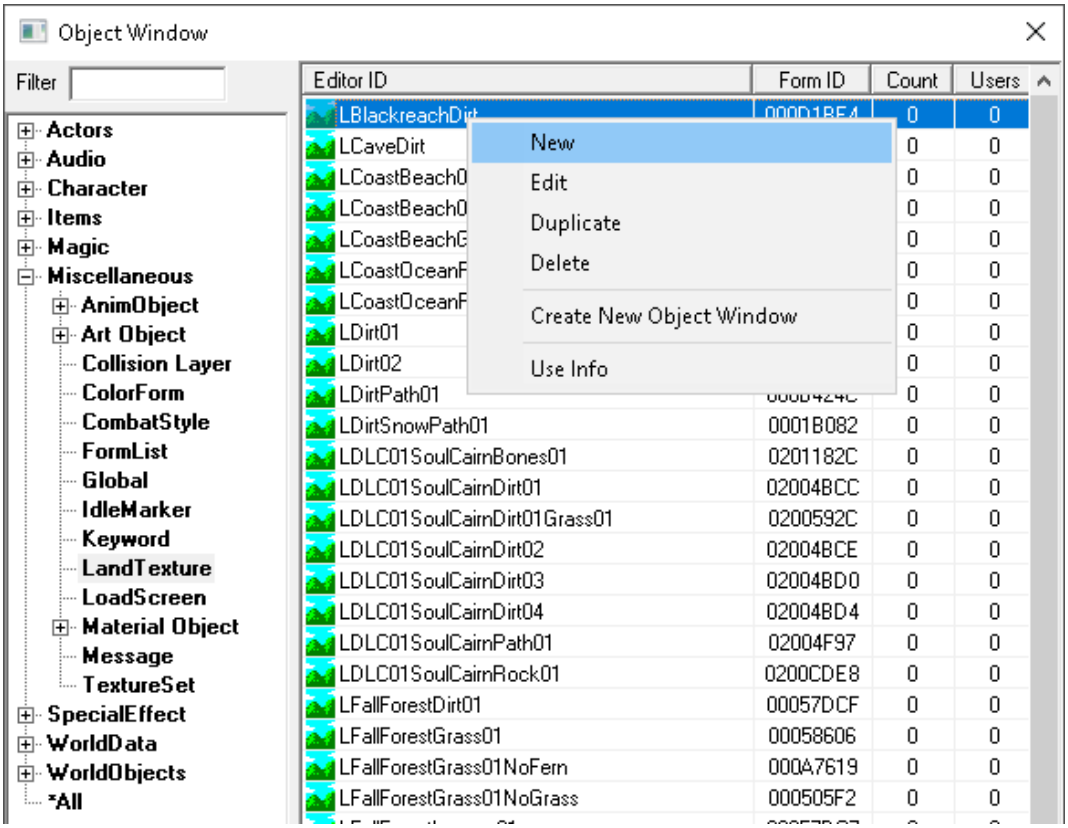

Figure 119 - Adding a new land texture.

Right-click on one of the existing land textures and select New.

Set the Texture Set drop-down to point to the texture set you created. For my example, I'm going to set the Material Type to 'MaterialSand', the Friction to '2' and the Restitution to '0'.

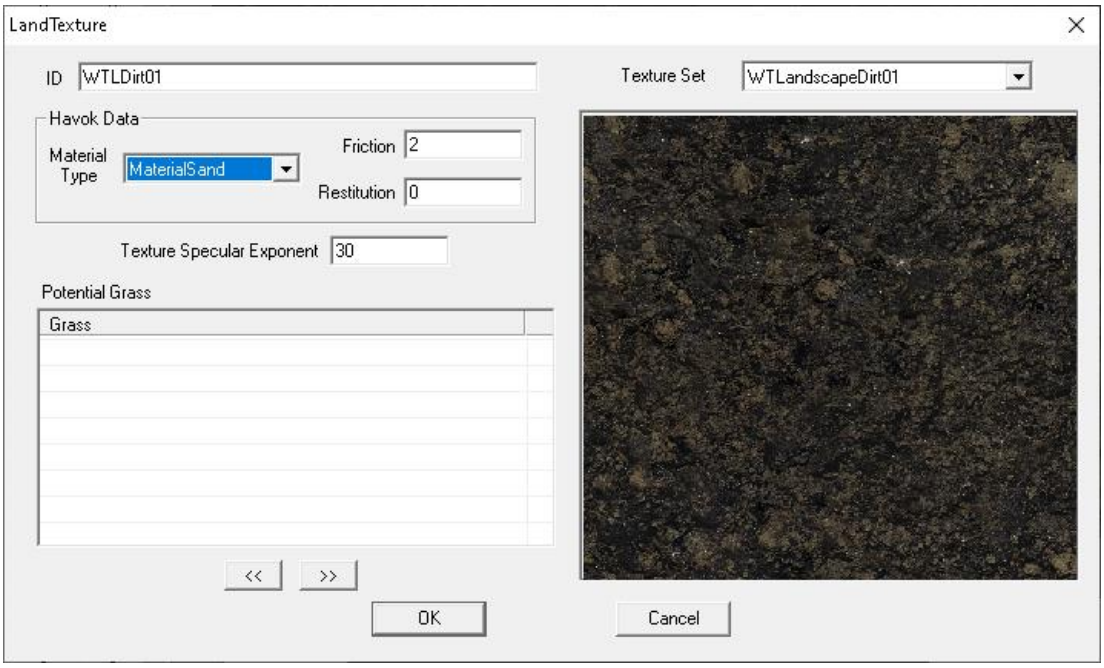

Figure 120 - Setting Land Texture properties.

To get the right values, I'd recommend taking a look at a similar existing texture.

Let's say we also wanted to add grass or rocks as we paint with our new landscape texture.

In the Object Window, browse to WorldObjects > Grass.

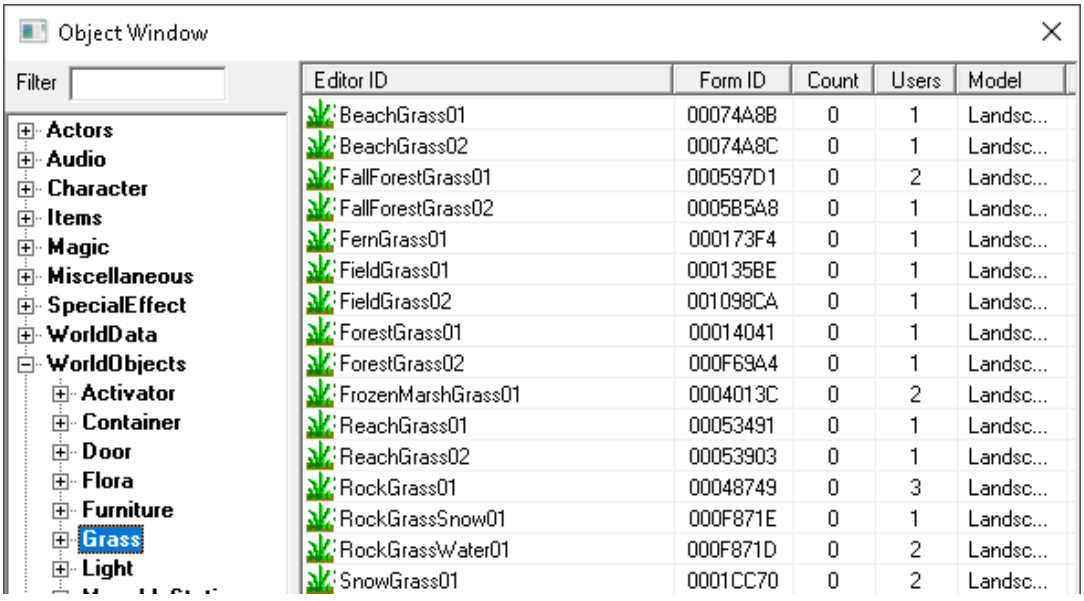

Figure 121 - Grass.

Highlight the object you want the landscape texture to potentially create, and drag and drop it into the Potential Grass field.

You can drag and drop multiple selected grass types at a time.

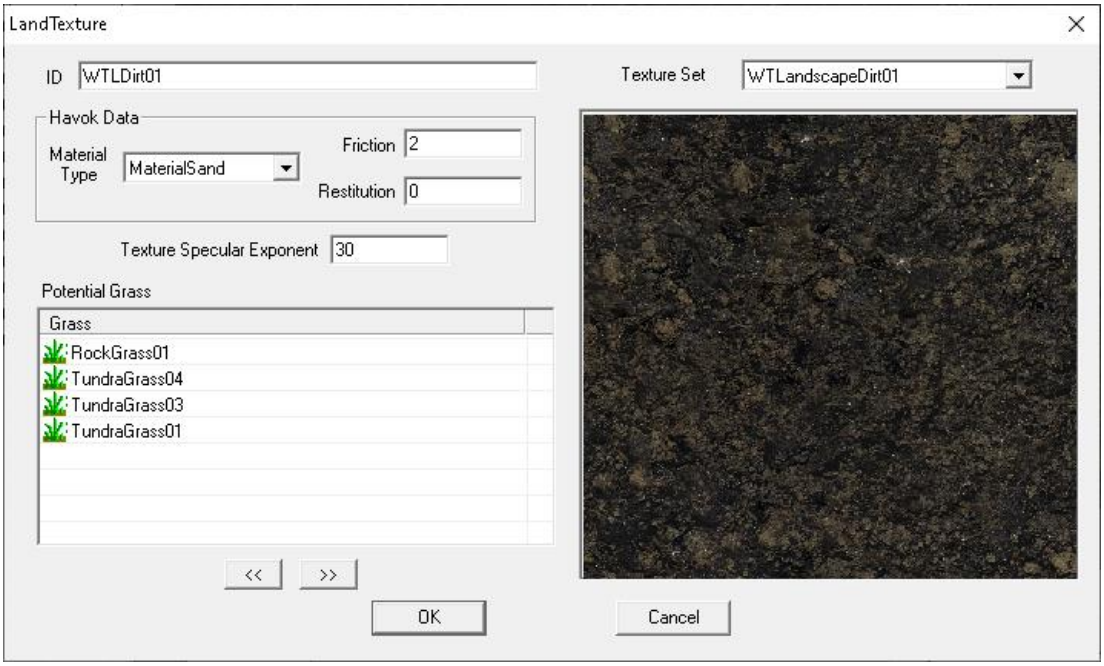

Figure 122 - Potential Grass added to our landscape texture.

Click OK.

Now we can start painting with our new landscape texture.

Important: The Creation Kit may crash after adding grass to a landscape texture, so make sure you save immediately and relaunch the Creation Kit.

And there's our new texture painted on the landscape, with grass.

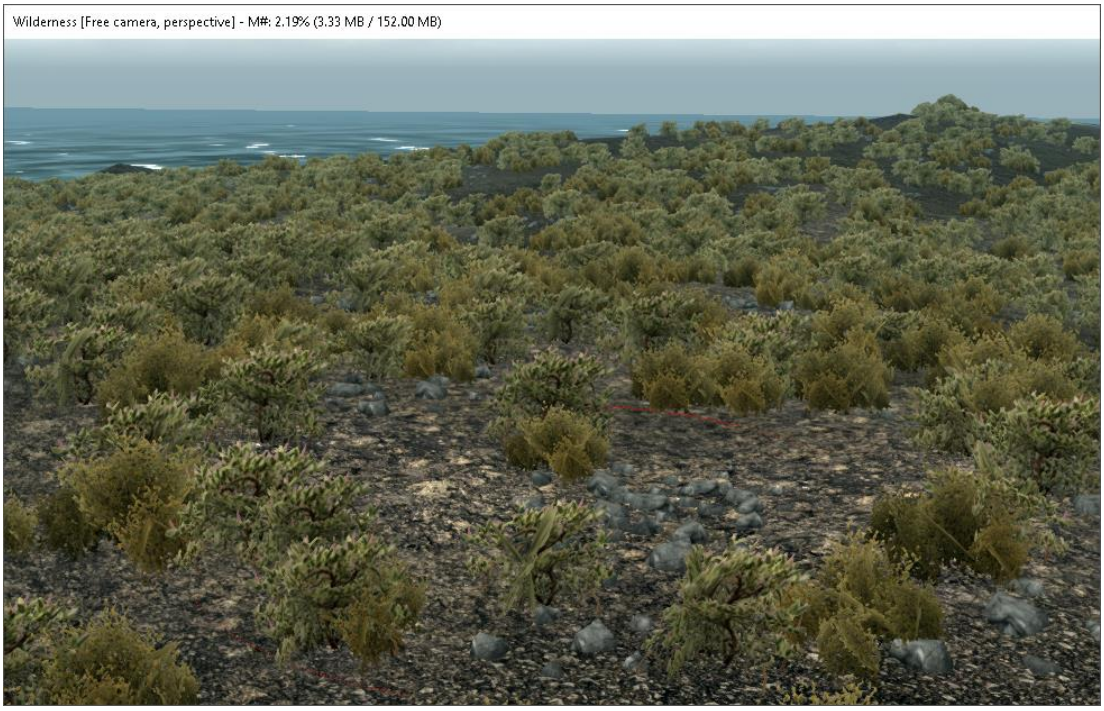

Figure 123 - Our new texture painted on the landscape.

Click on the 'Toggle Grass' button in the toolbar or press '8' to toggle grass off to see the textured landscape without it.

Figure 124 - Our new texture with grass toggled off.

ADDING LAKES AND RIVERS

Lakes and rivers can be added to your world space in a couple of different ways.

In this first example, I'm going to use a water plane. Water planes are useful for adding small lakes or rivers that are either above or below sea level.

In the Object Window, go to WorldObjects > Activator and filter by 'water'.

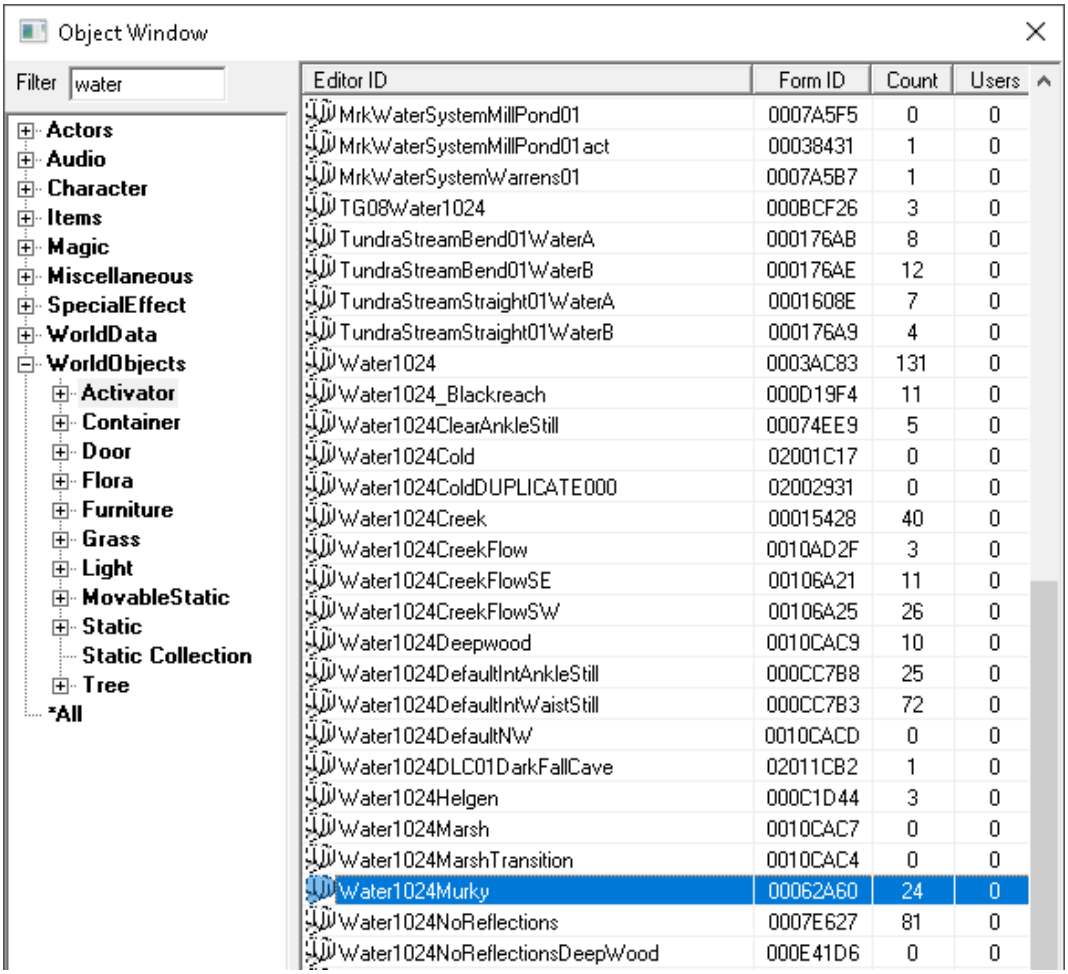

Figure 125 - Water planes.

I'm going to use Water1024Murky in this example because it doesn't flow in any particular direction, which is more realistic for filling a small pond.

Drag and drop the water plane into the render window.

Here you can see the water plane floating above the small pond I sculpted into the terrain.

To raise or lower the plane, hold down 'Z' while left-click dragging the mouse to lock movement to the Z axis.

Note: The water transparency may not update immediately after moving a water plane up or down, so press 'F5' to refresh the render window.

As you can see, the water plane is too small. So let's resize it so that it fills up the pond entirely.

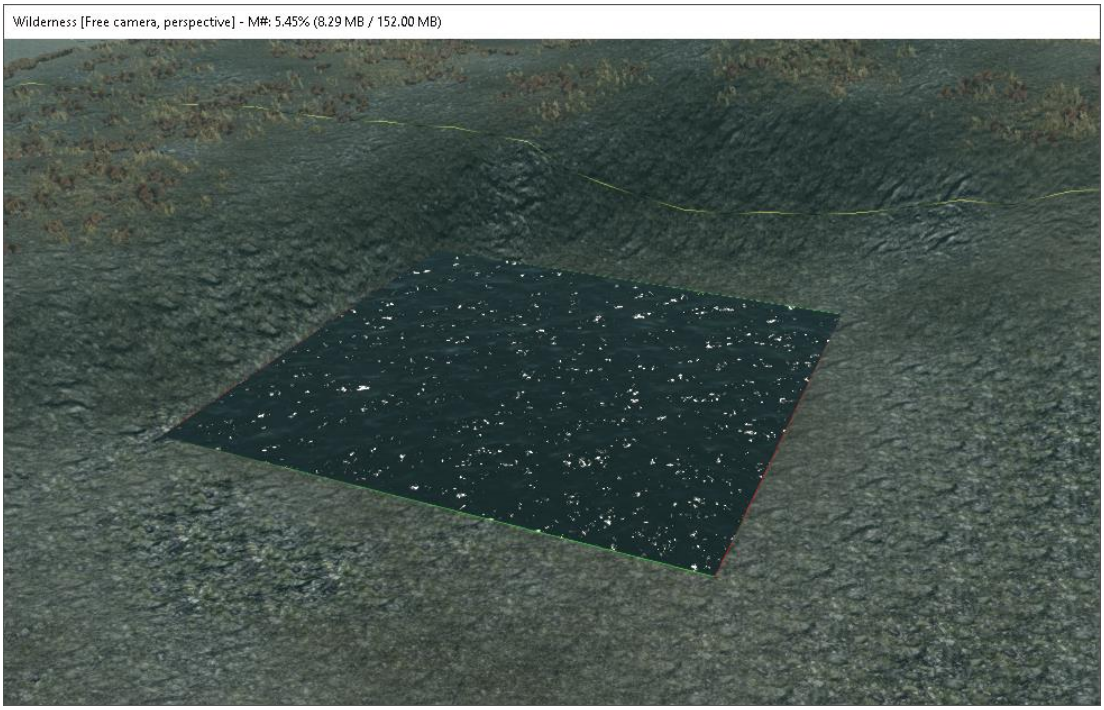

Figure 126 - Water plane added to our world space.

Double-click or right-click on the water plane and select Edit.

In the Reference properties, go to the 3D Data tab and change the Scale. In my example, I'm going to set the Scale to 3.0000.

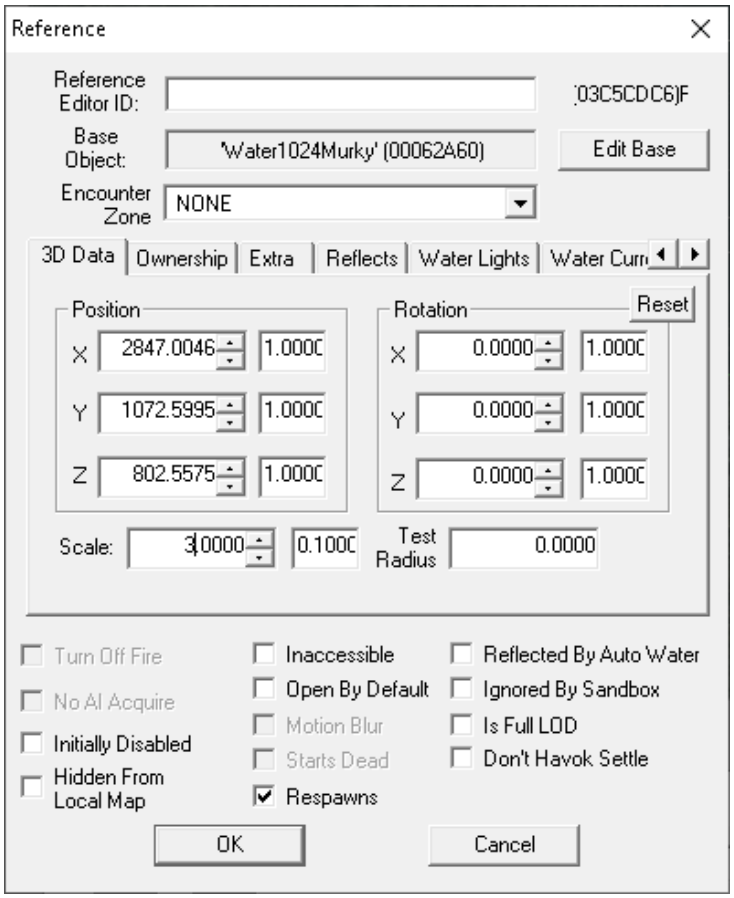

Figure 127 - Changing the scale of the water plane.

Click OK to close out of the Reference properties.

Note: Unlike increasing the scale of an object, increasing the scale of a water plane won't affect the scale of the water texture.

In the following screenshot, you can see that the water plane now fills the pond entirely.

Figure 128 - The water plane now reaches the edge of the pond.

Another way to fill a pond would be to turn on 'Snap to Grid' by pressing 'Q' and snap multiple water planes together. This may work better for ponds that are irregular in shape.

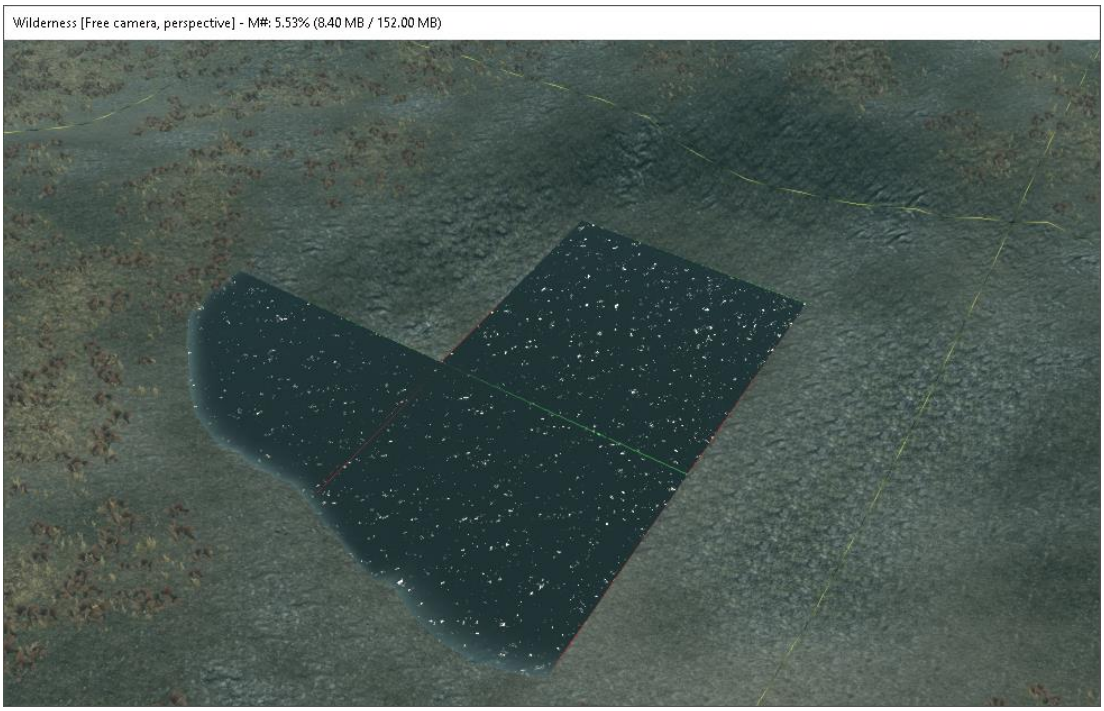

Figure 129 - Snapping multiple water planes together instead.

Another thing we can do is change the water type of the ocean layer on a per cell basis. Generally you'd want to do this for large bodies of water like lakes or swamps.

In the Cell View, right-click on the cell you want to change the water type for and select Edit.

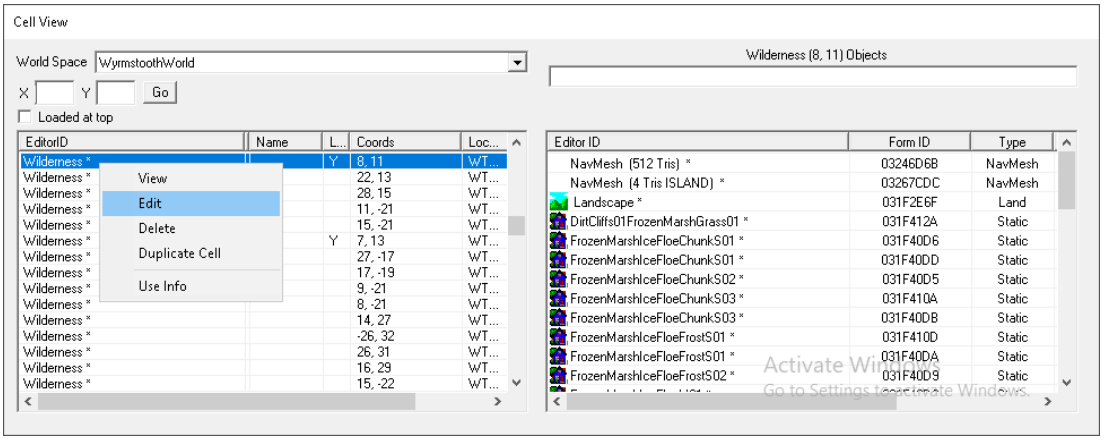

Figure 130 - Editing cell properties.

Change the Water drop-down. In my example I set it to MurkyWater.

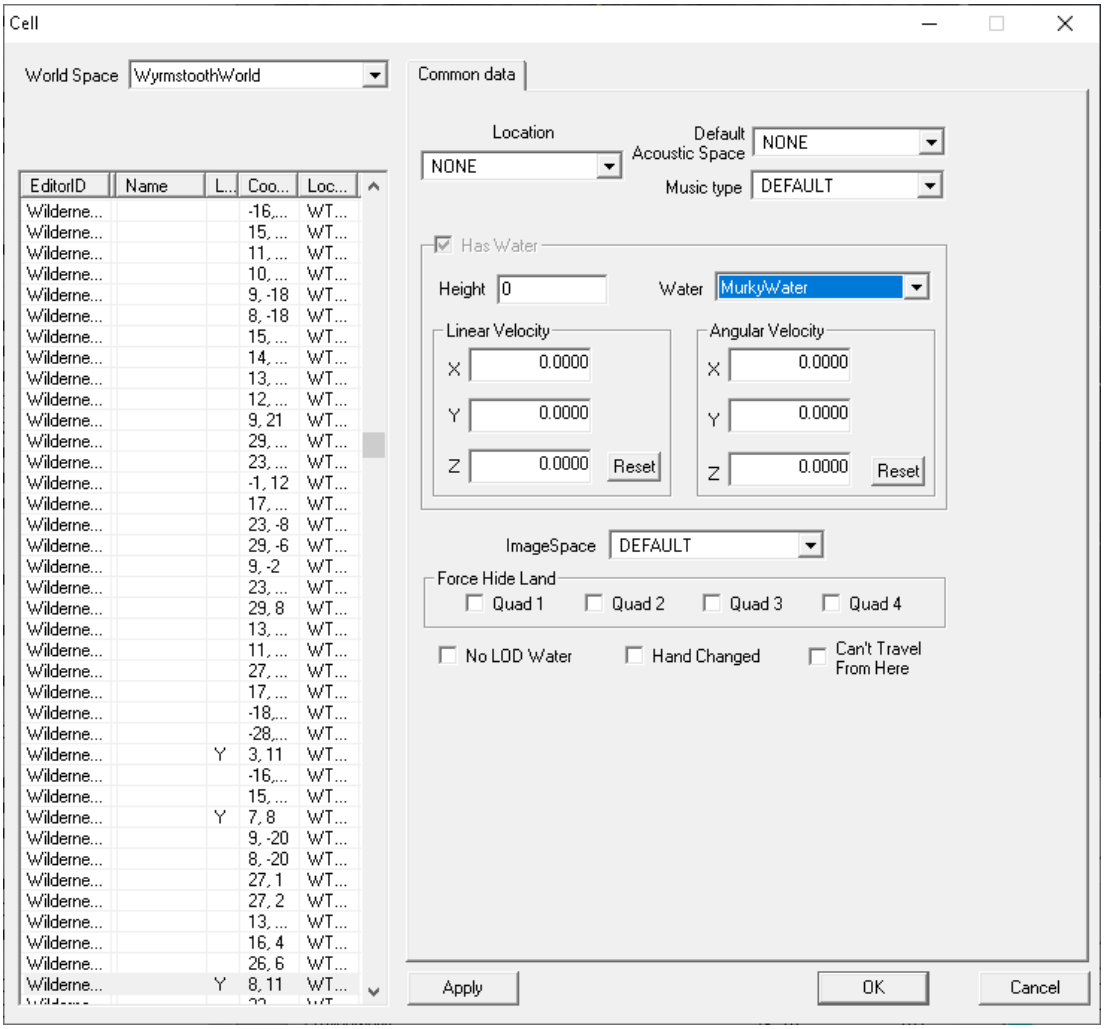

Figure 131 - Changing the water type of a specific cell.

Click OK.

And here's a screenshot of a cell with its water type changed:

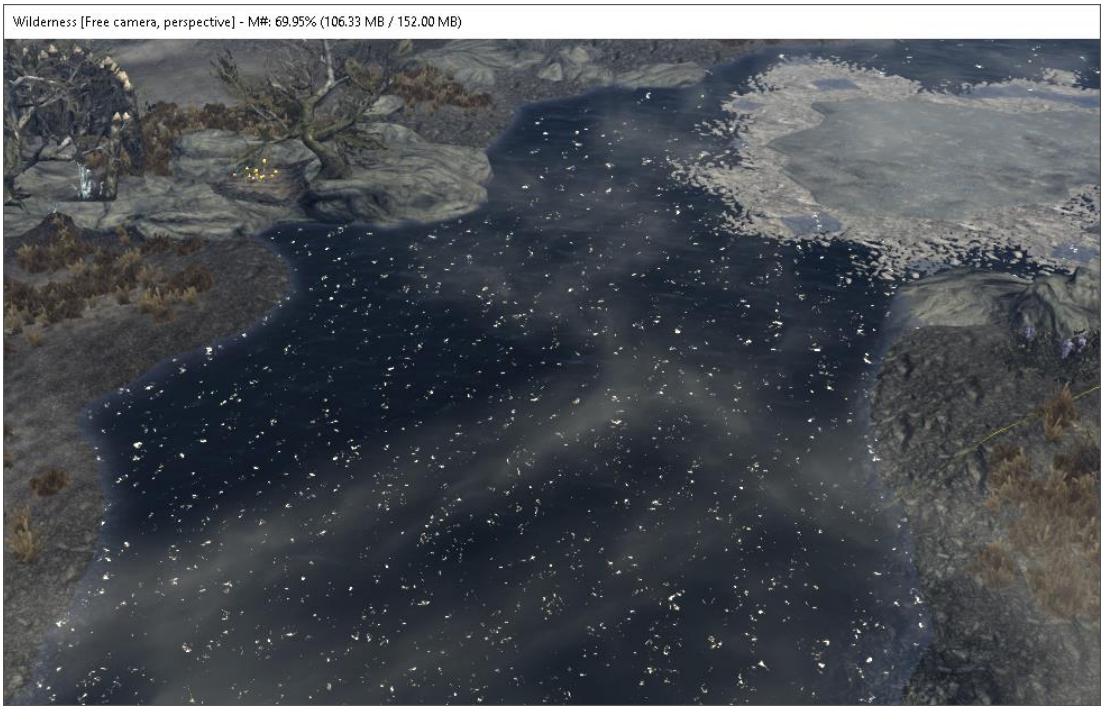

Figure 132 - Water type for cell has changed.

Note: If your lake or river spans multiple cells, you'll need to change the water type in each cell.

If your river or lake borders the ocean, you'll need to be a bit creative with how you cover up the transition from the water type you're using to the default ocean water type.

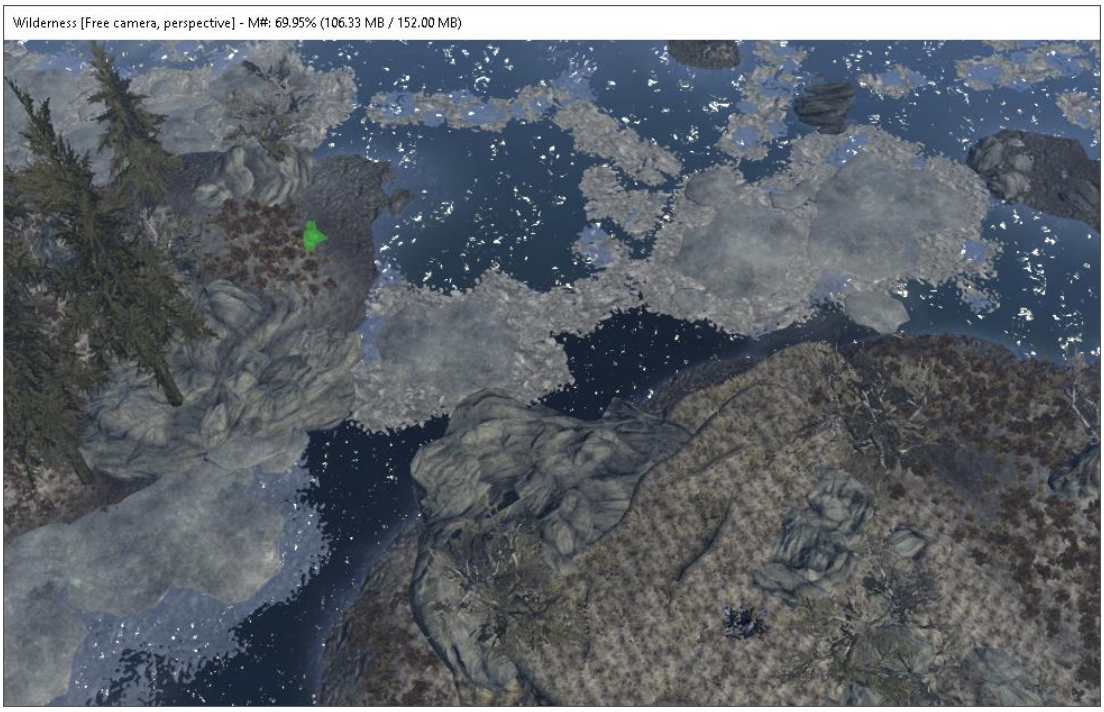

Figure 133 - Where two different water types meet.

In the screenshot above, I added some ice over the top of the cell border to cover the visible seam between two different water types.

Here's that screenshot again, but with the ice objects removed to show you what that seam between two different water types along the cell border looks like:

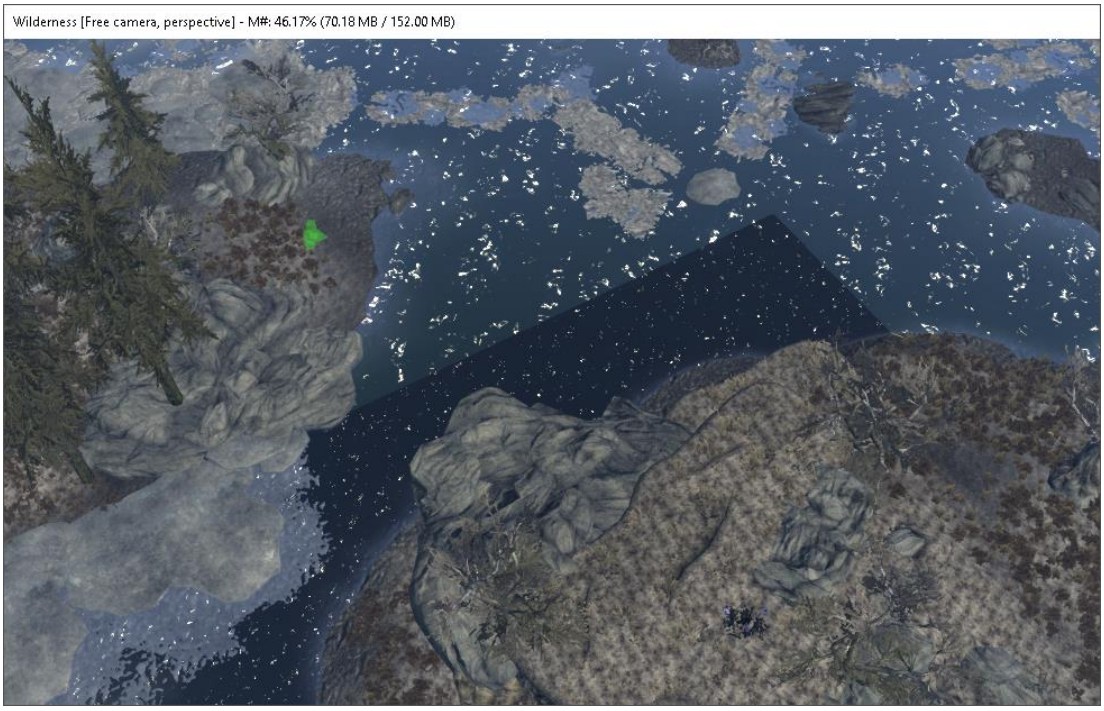

Figure 134 - Ice removed.

You can also change the height of the water in cell properties.

In the following example, I set Height to -6000.

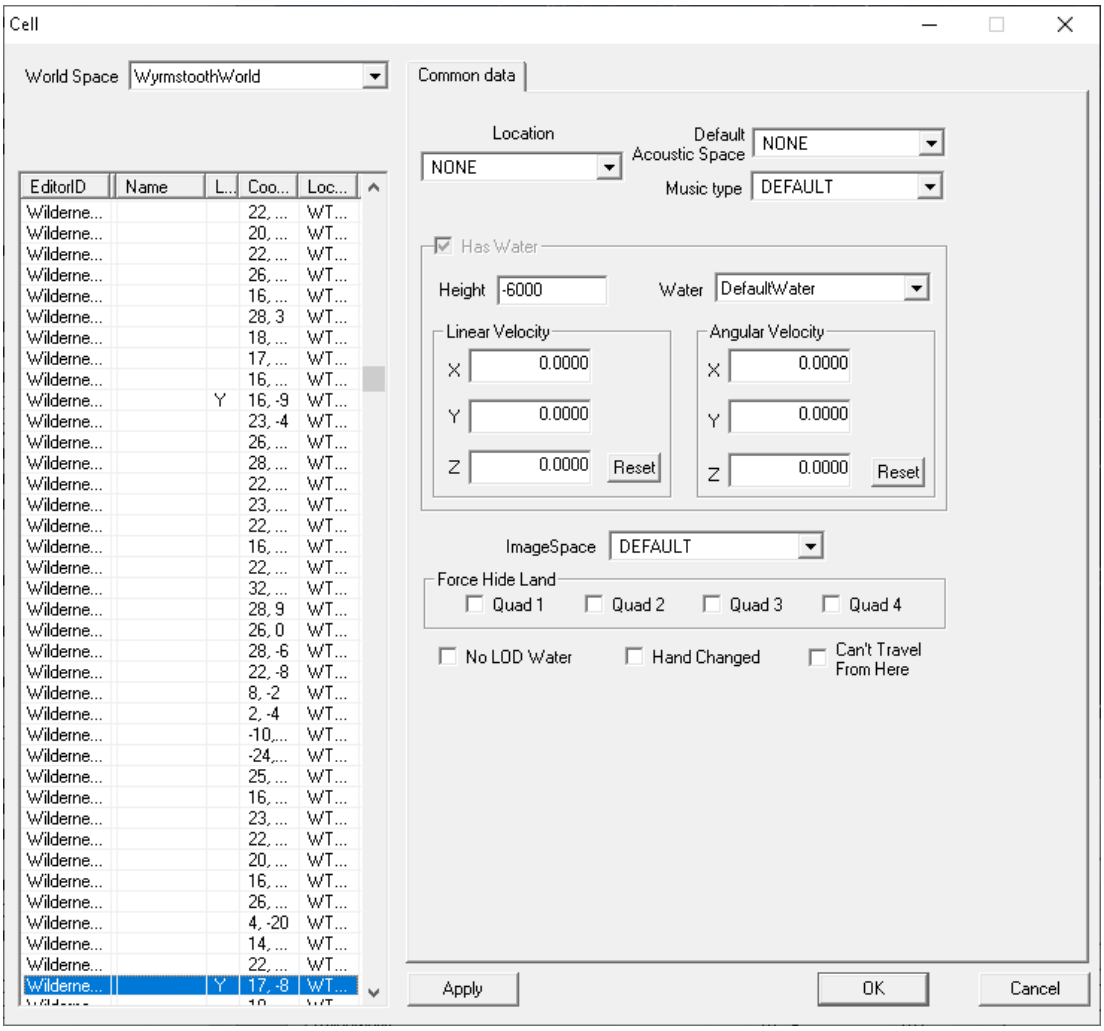

Figure 135 - Lowering a cell's water.

By lowering a cell's water below the default sea-level, I can have areas of the map that are below sea-level but are not underwater.

For example, on the left hand side of the following screenshot, I have a deep pit that the player can walk down into. This pit is below sea-level so I had to reduce the cell's water height by -6000 units.

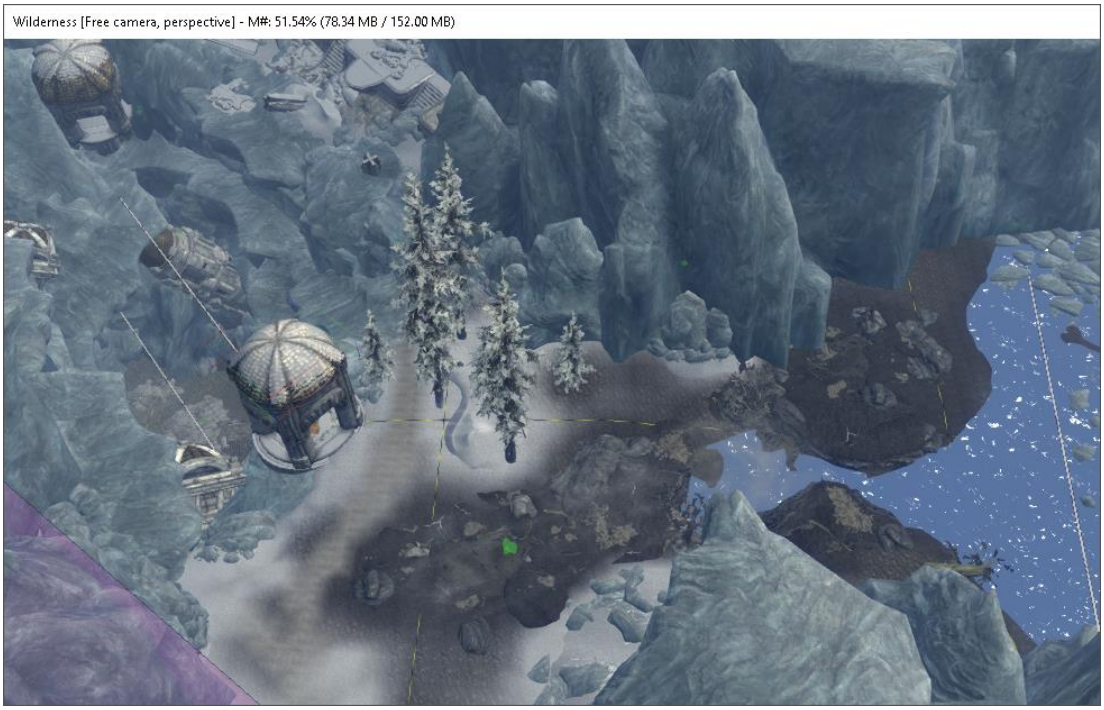

Figure 136 - An area of the map below sea-level.

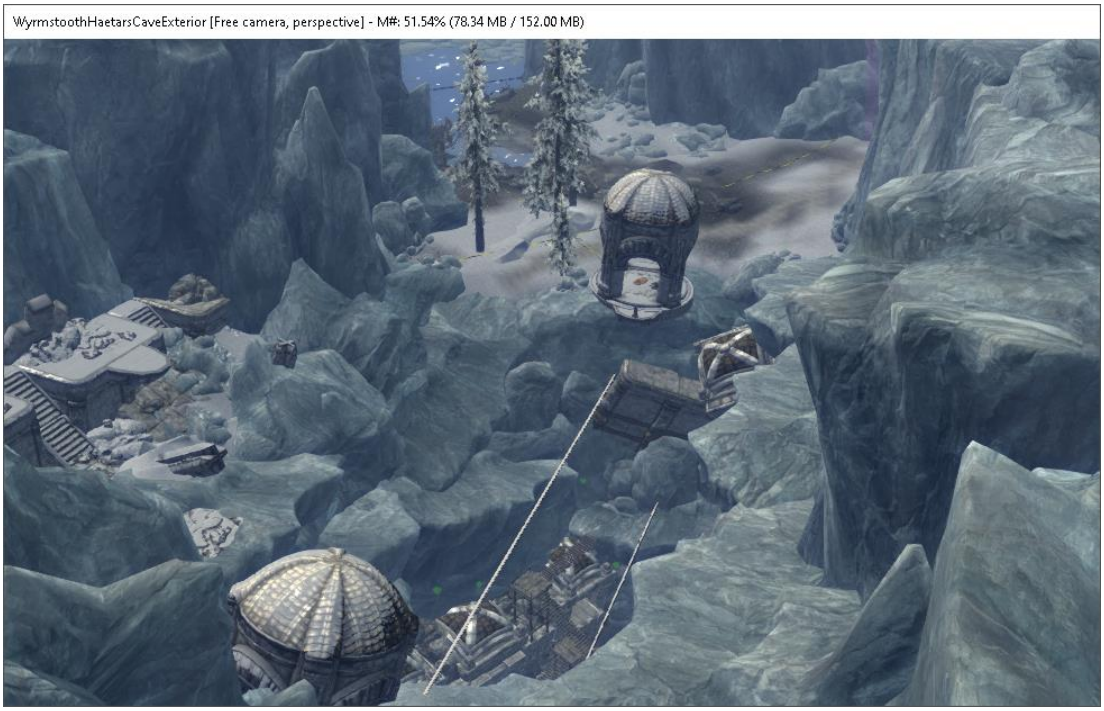

Figure 137 - The pit from another angle.

SETTING UP WATER FLOW AND CURRENTS

Skyrim.esm includes several water planes for creeks and rivers for different flow directions, e.g.: Water1024CreekFlow, Water1024CreekFlowSE and Water1024CreekFlowSW.

Figure 138 - Water planes with different flow directions.

But what if we need a water plane to flow in a very specific flow direction, or with a stronger current? We'll need to create our own.

Note: In this section I'll be talking about water flow and currents. Just so we're on the same page, when I mention water flow I'm talking about the direction of the water shader on the surface of the water plane. When I mention current I'm talking about the direction that NPCs or physics-enabled objects would be pulled in if they fell in.

To do so, firstly browse to WorldData > WaterType.

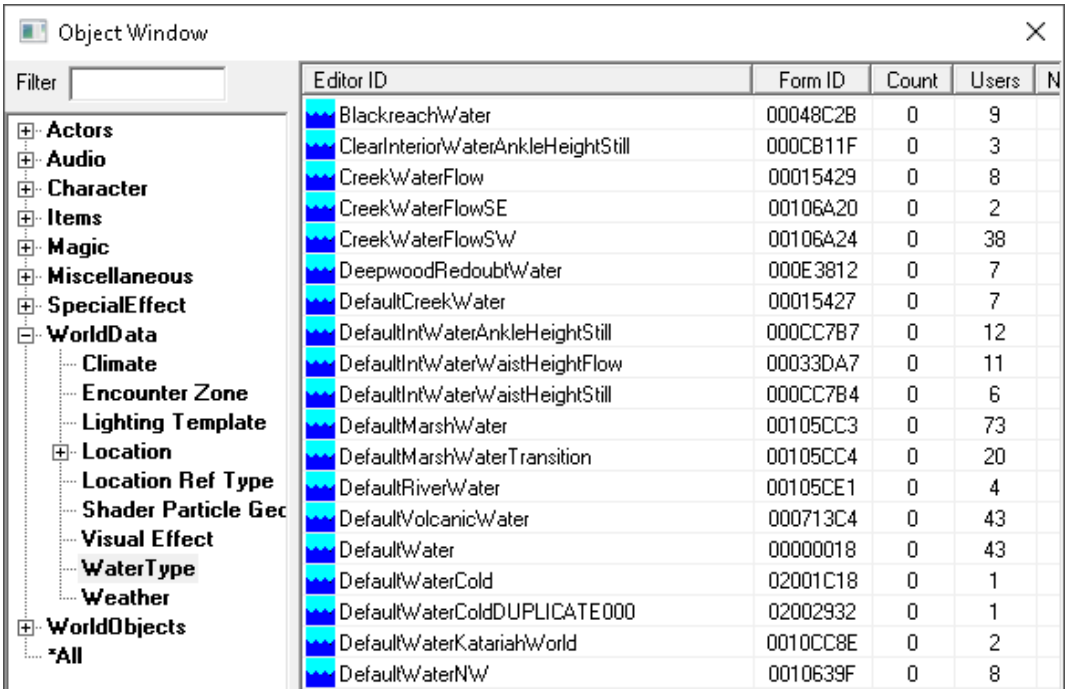

Figure 139 - Default water types.

For this example, I want to specify the direction of a flowing creek.

Figure 140 - A sample creek, with water flowing from right to left.

Right now, in the example above, I'm using Water1024Creek. The water flows from right to left, but I want to change this direction.

Right-click on CreekWaterFlow and select Duplicate.

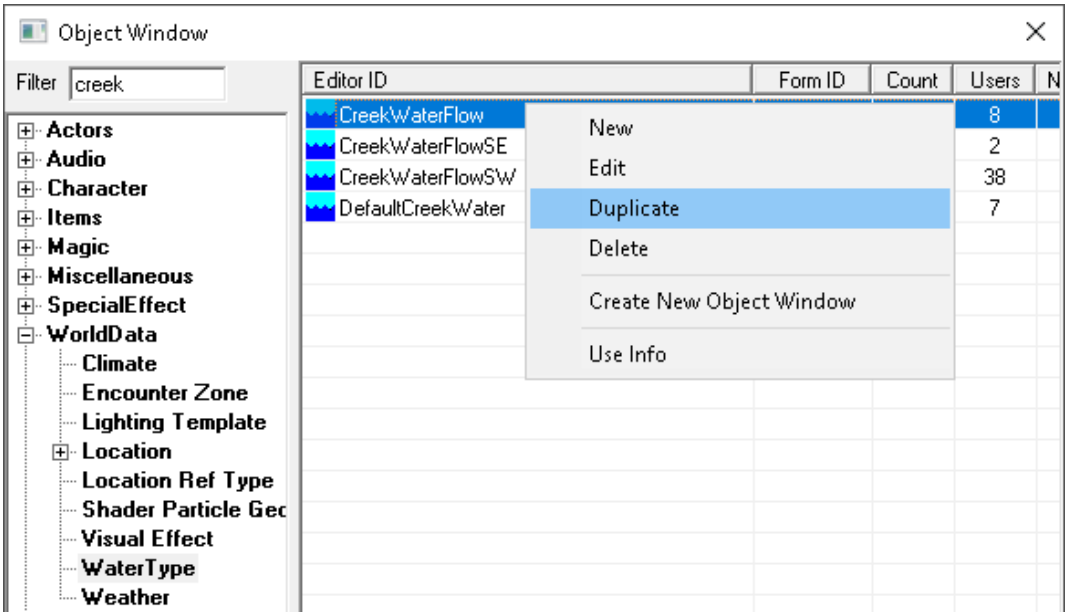

Figure 141 - Duplicating an existing water type.

Rename your water type. In my example, I just named it CreekWaterFlow with a 'WT' prefix.

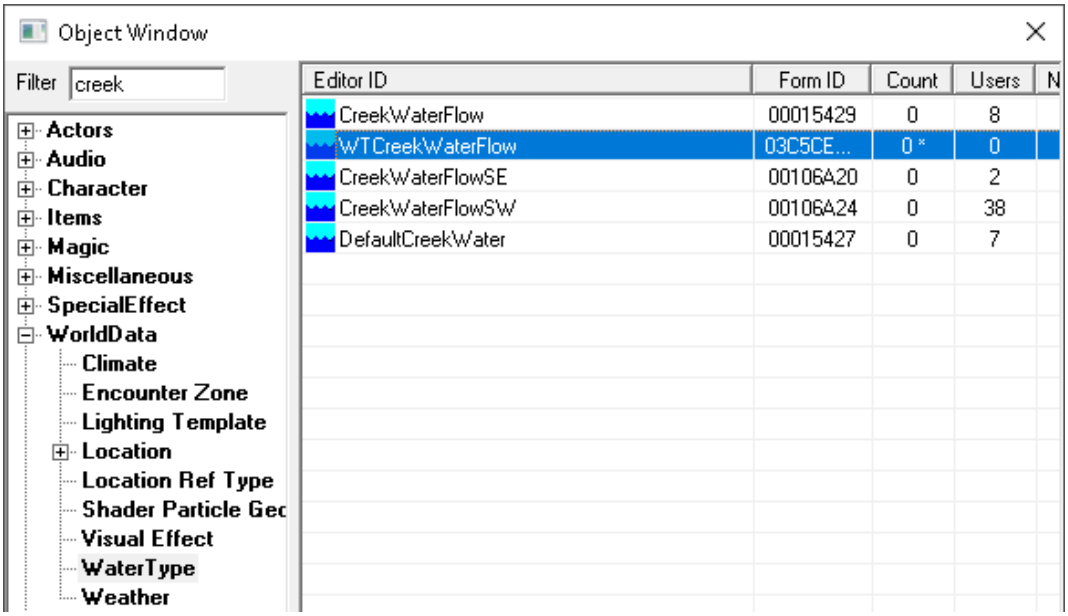

Figure 142 - Renaming our new water type.

Go to the Noise Properties tab.

Set the Wind Direction slider for Noise Layer One to 360.

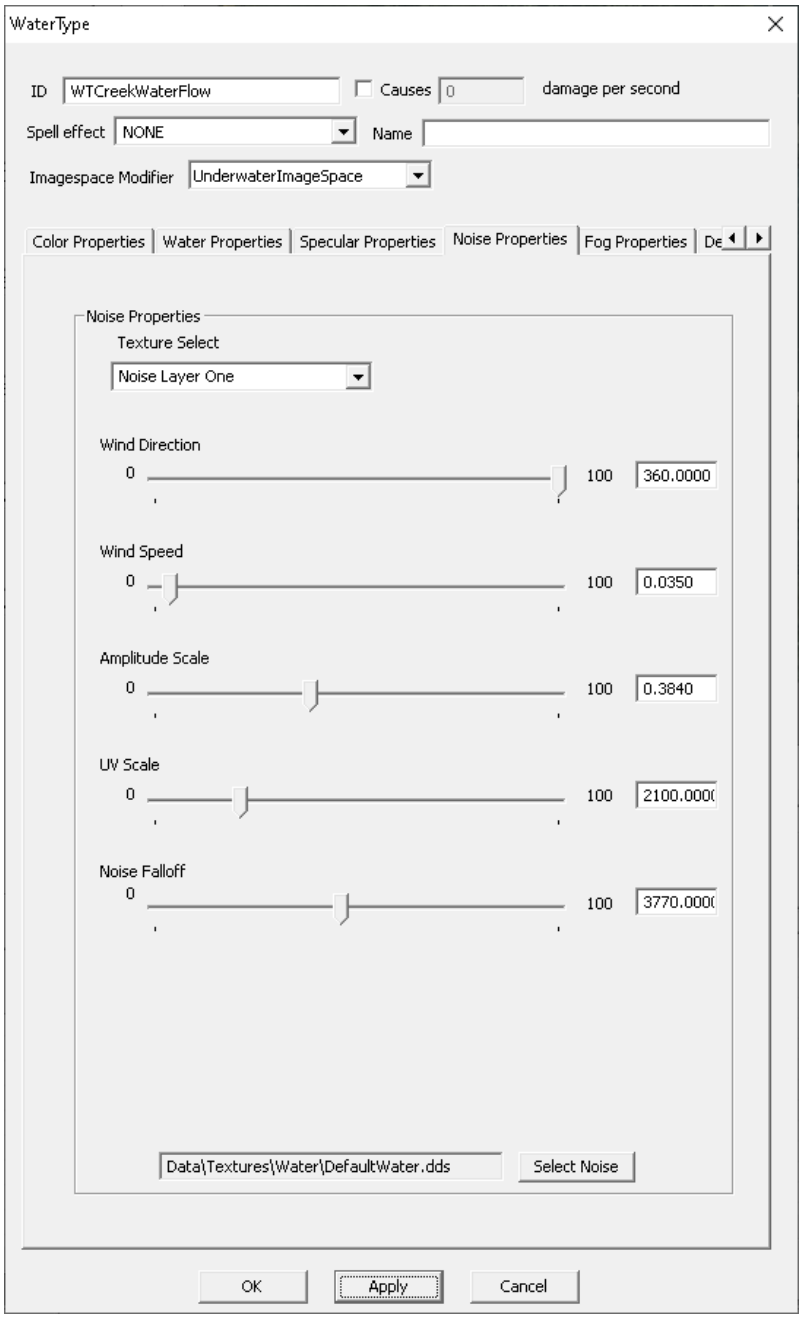

Figure 143 - Noise Layer One direction.

Set the Texture Select drop-down to Noise Layer Two.

Set the Wind Direction to 300.

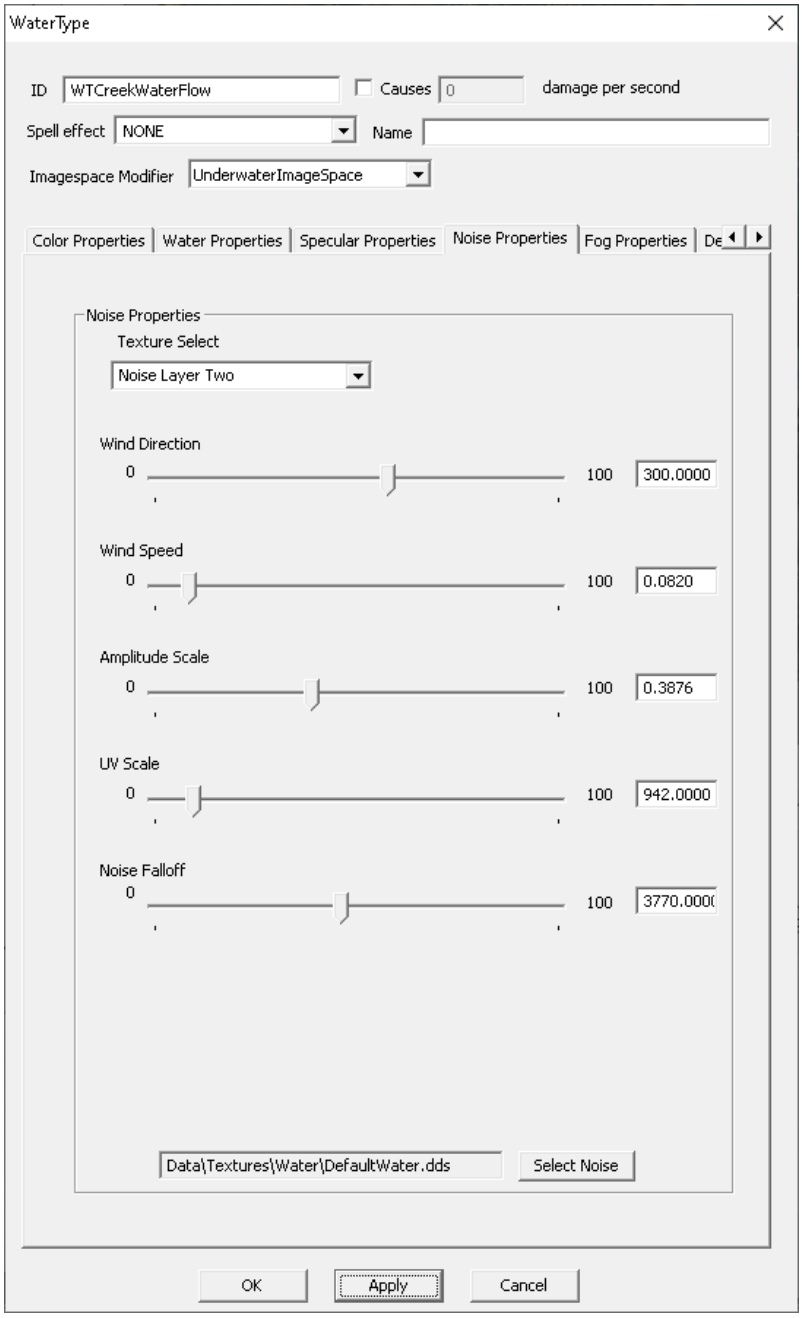

Figure 144 - Noise Layer Two direction.

Lastly, set the Texture Select drop-down to Noise Layer Three.

Set the Wind Direction to 300.

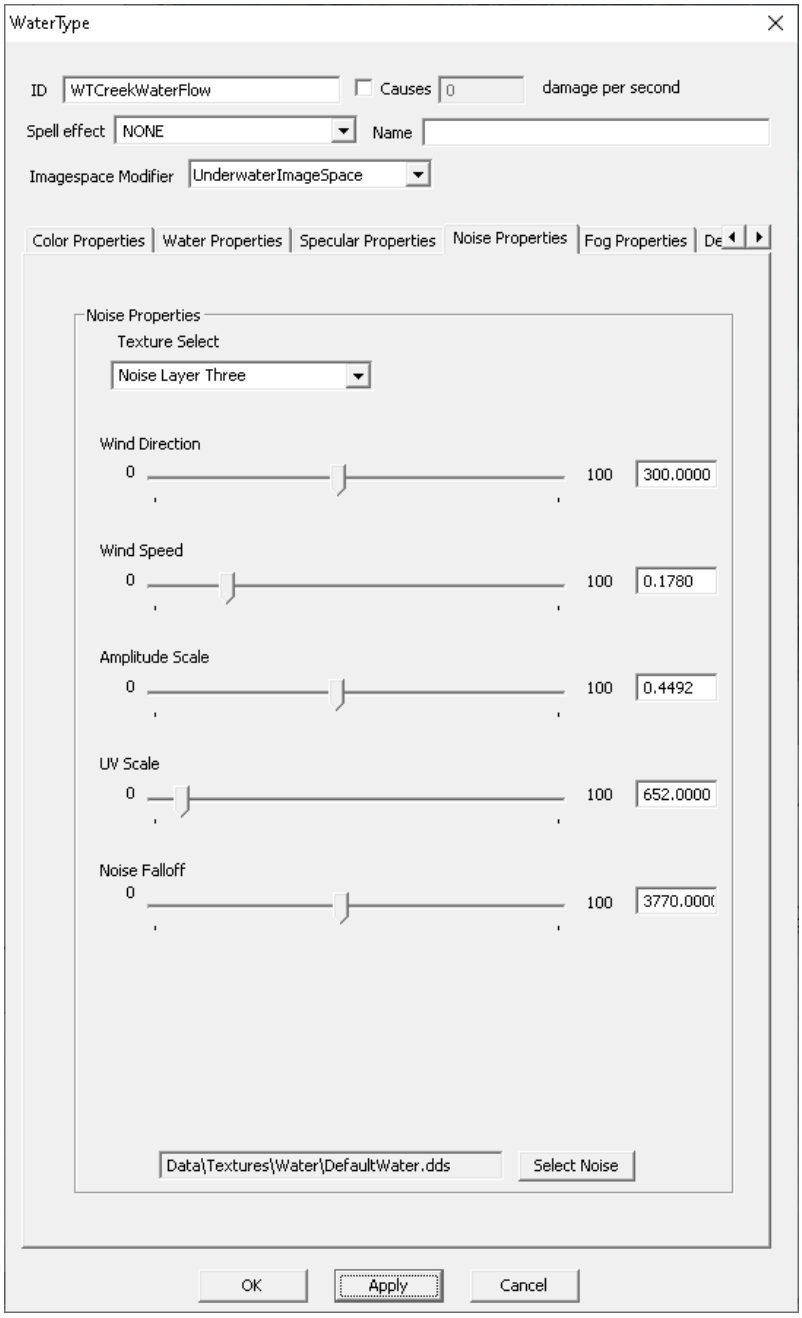

Figure 145 - Noise Layer Three direction.

Click OK to close the WaterType properties.

Next, we need to create a new water plane activator.

In the Object Window, go to WorldData > Activator.

Filter by 'creek'.

Right-click on 'Water1024Creek' and select Duplicate.

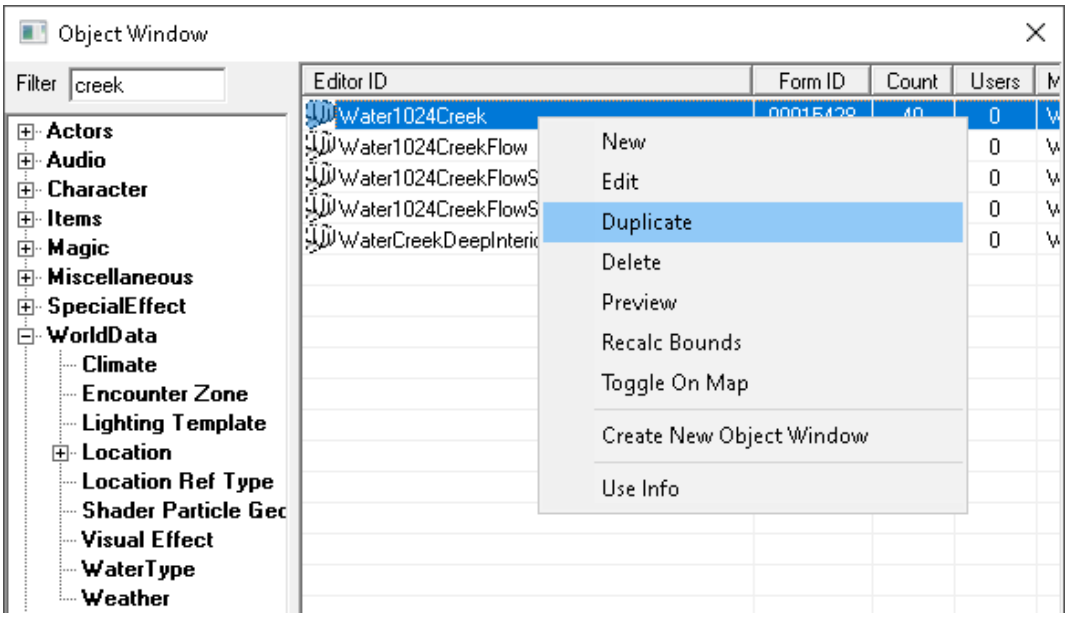

Figure 146 - Duplicating Water1024Creek.

For my example, I just named it Water1024CreekFlow with a 'WT' prefix.

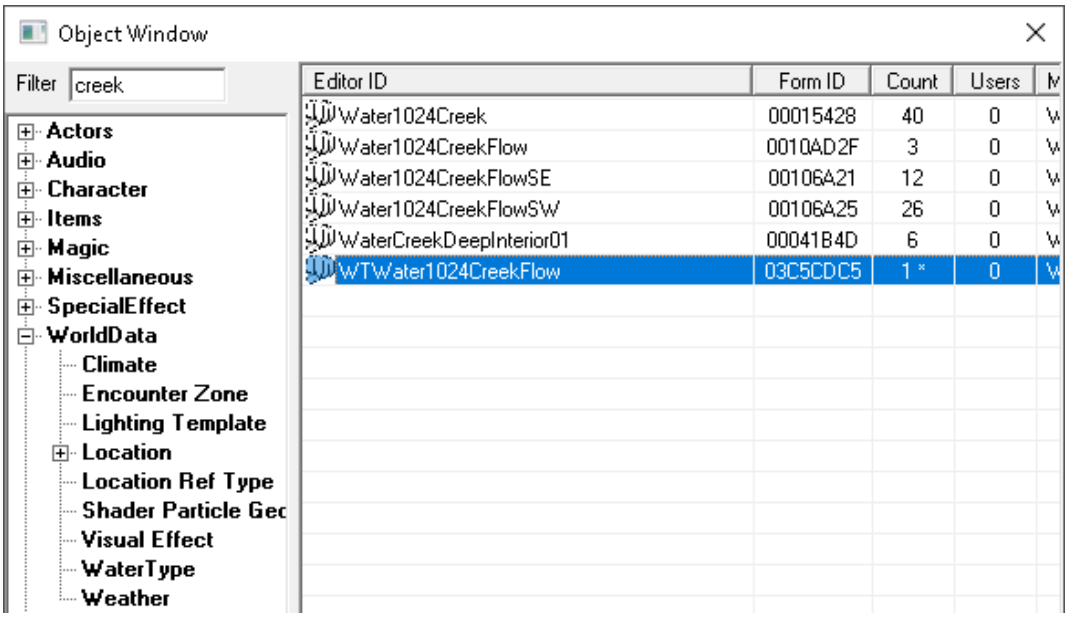

Figure 147 - Renaming the water activator.

Click on the water plane in the render window and press CTRL+F to bring up the Search & Replace screen.

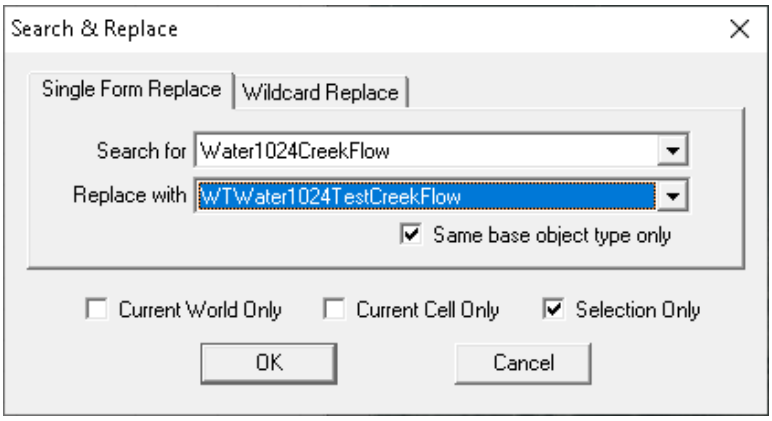

Figure 148 - Changing the water plane.

In the 'Replace with' drop-down, choose the water plane you just created. In my example that's going to be WTWater1024TestCreekFlow.

Click OK.

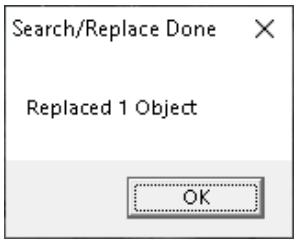

Figure 149 - Search/Replace Done.

Click OK again to the Search/Replace Done pop-up.

Press 'F5' to refresh the render window.

Obviously it's a bit hard to tell from a static screenshot, but the direction of the creek has now reversed and is flowing from left to right.

Figure 150 - Creek is now flowing in the opposite direction.

Now that our water activator is in place, go back to WorldData > WaterType in the Object Window.

We can make further adjustments to the water type properties and use the Apply button to see our changes update in the render window without having to close the properties or use 'F5' to refresh.

For example, if we decrease the Fog Amount in the Fog Properties tab to 0.3000 and click Apply, our creek will now appear a lot clearer in the render window.

Figure 151 - The creek with a reduced Fog Amount.

Alright, so let's say we want our creek to run a bit faster.

Go back to the Noise Properties tab.

For Noise Layer One, set the Wind Speed to 0.0680.

For Noise Layer Two, set the Wind Speed to 0.1090.

And for Noise Layer Three, set the Wind Speed to 0.1090.

Press Apply.

You should see the speed of the creek water update in the render window.

For more information about each field, check out the WaterType article on the Creation Kit wiki.

Now that we've changed the direction our creek is flowing, let's also change the direction of the current.

In this example I'm using a water plane to create the creek, so double-click or right-click on the water plane and select Edit.

Go to the Water Current tab.

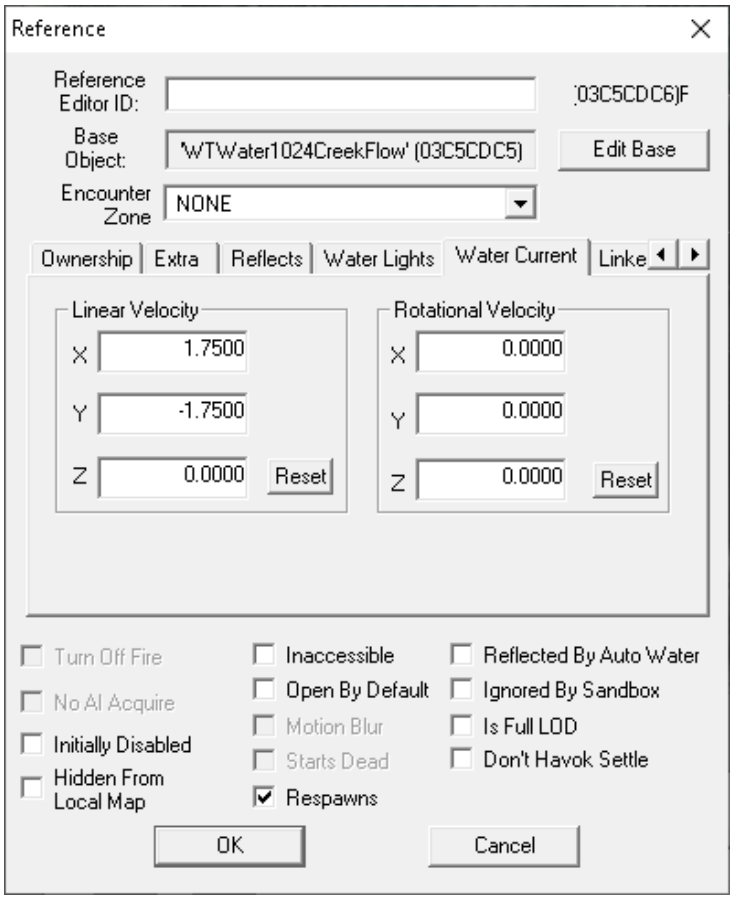

Figure 152 - Setting a water current.

For my example, under Linear Velocity, I'm going to set X to '1.7500' and Y to '-1.7500' to make the water current flow in the same direction as the waves.

The higher the numbers you set under Linear Velocity, the stronger the current.

Generally speaking you shouldn't modify the Z value under Linear Velocity.

Determining what values to set might take some trial and error, but you can use the move gizmo as a guide. With the water plane selected, press 'E' to bring it up.

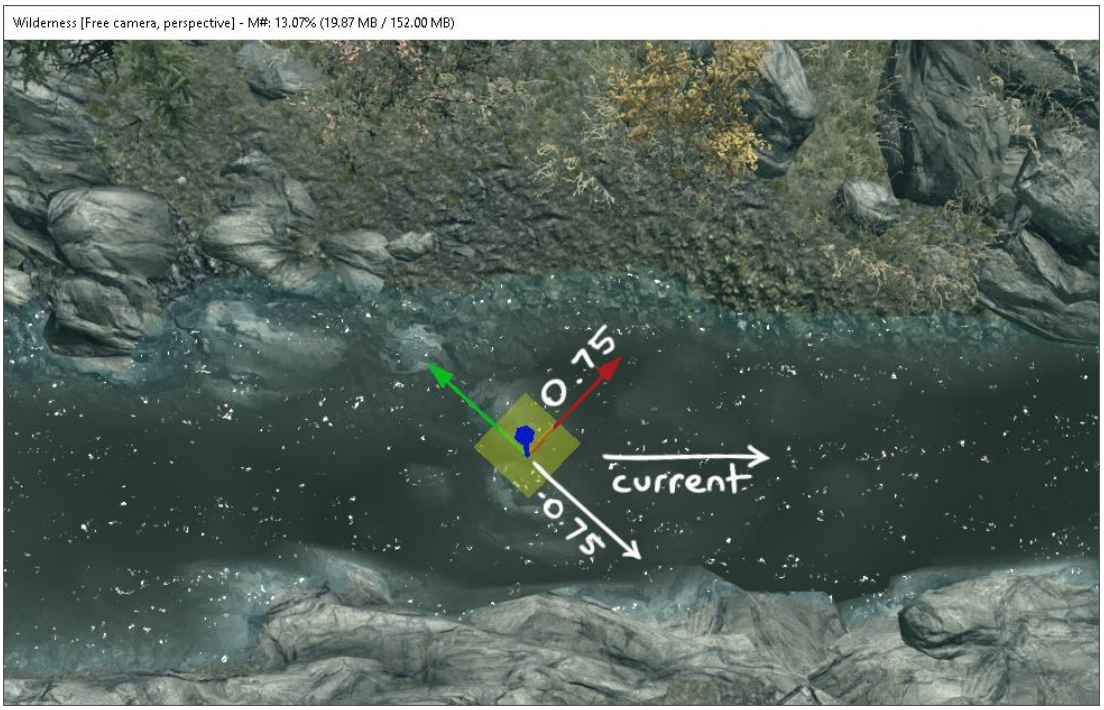

Figure 153 - World coordinates on the water plane.

So basically I want the water current to move from left to right, same as the water flow.

To do this I set X to 1.7500 because it's pointing towards the direction I want the water to go, and Y to -1.7500 because it's pointing away from the direction I want the water to go.

These two values are combined to make the current travel in the right direction.

Finally, I tested the water current out in-game and confirmed I was floating down the creek in the right direction.

Figure 154 - Floating down the creek.

If you wanted to change the current of the cell water instead, right-click on the current cell in Cell View and select Edit.

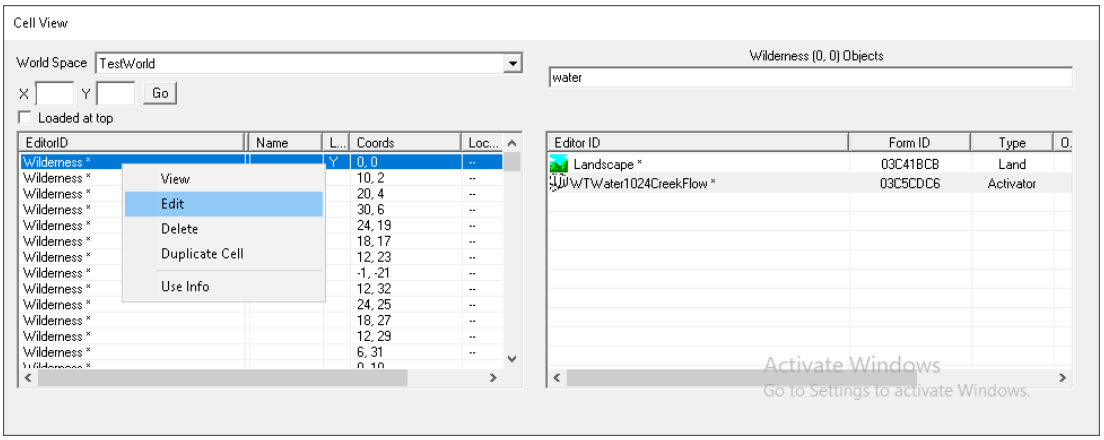

Figure 155 - Editing a cell's properties.

Like the Water Current tab in a water plane reference's properties, you can set the direction and strength of the water current under Linear Velocity.

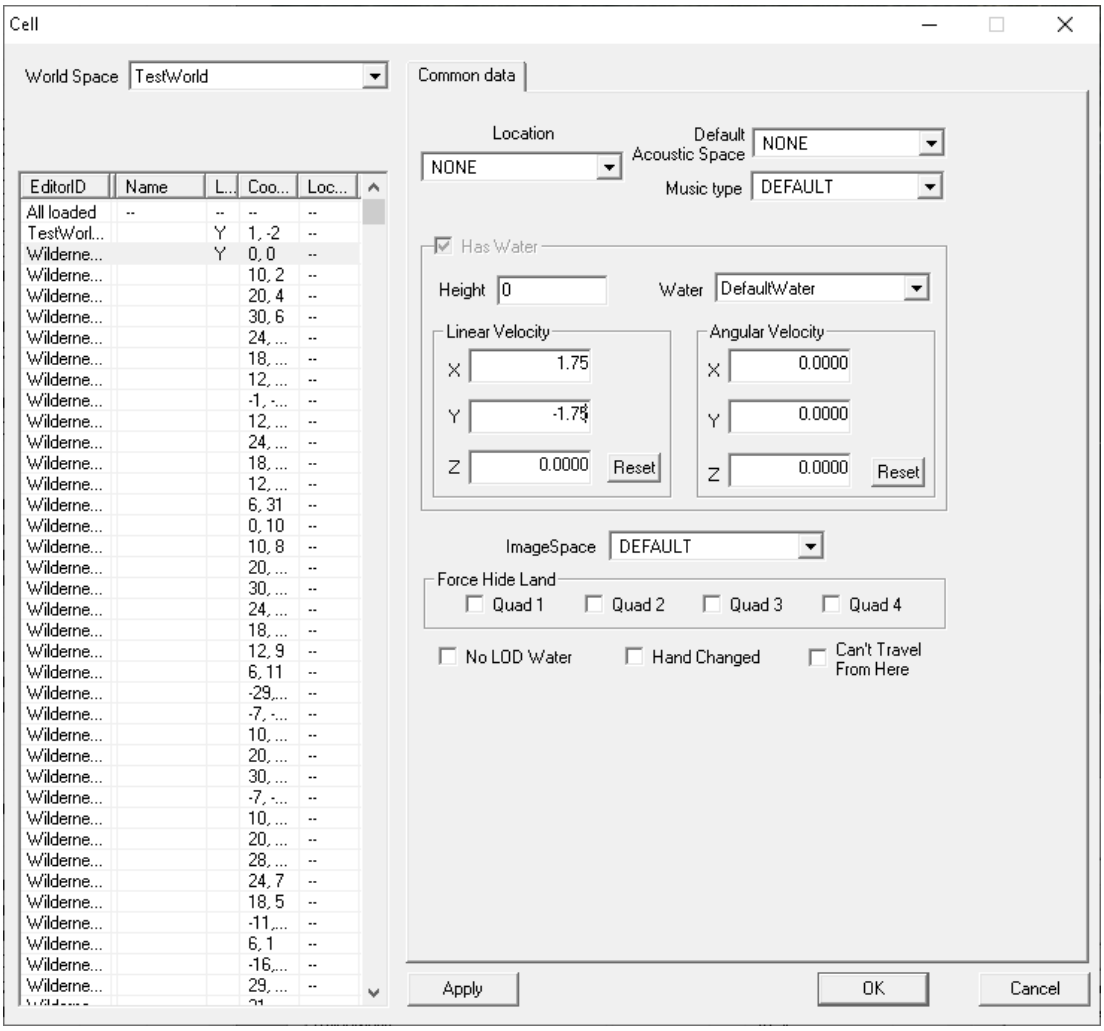

Figure 156 - Setting a current on the cell water.

Then click OK to close the cell's properties.

ADDING REGIONS

Regions are a collection of world space cells. They can be used to create separate biomes with different weather types and ambient sounds, and so on.

For example, in Wyrmstooth I created 'WyrmstoothRegion' to act as a border region to prevent players from swimming out too far into the ocean. This is the region with the red border in the screenshot below. Within 'WyrmstoothRegion' I also defined 'WyrmstoothForest', 'WyrmstoothMarsh' and 'WyrmstoothSteampools' to cover the different biomes in my world space.

Regions can also be used to automatically populate parts of your world space with static objects.

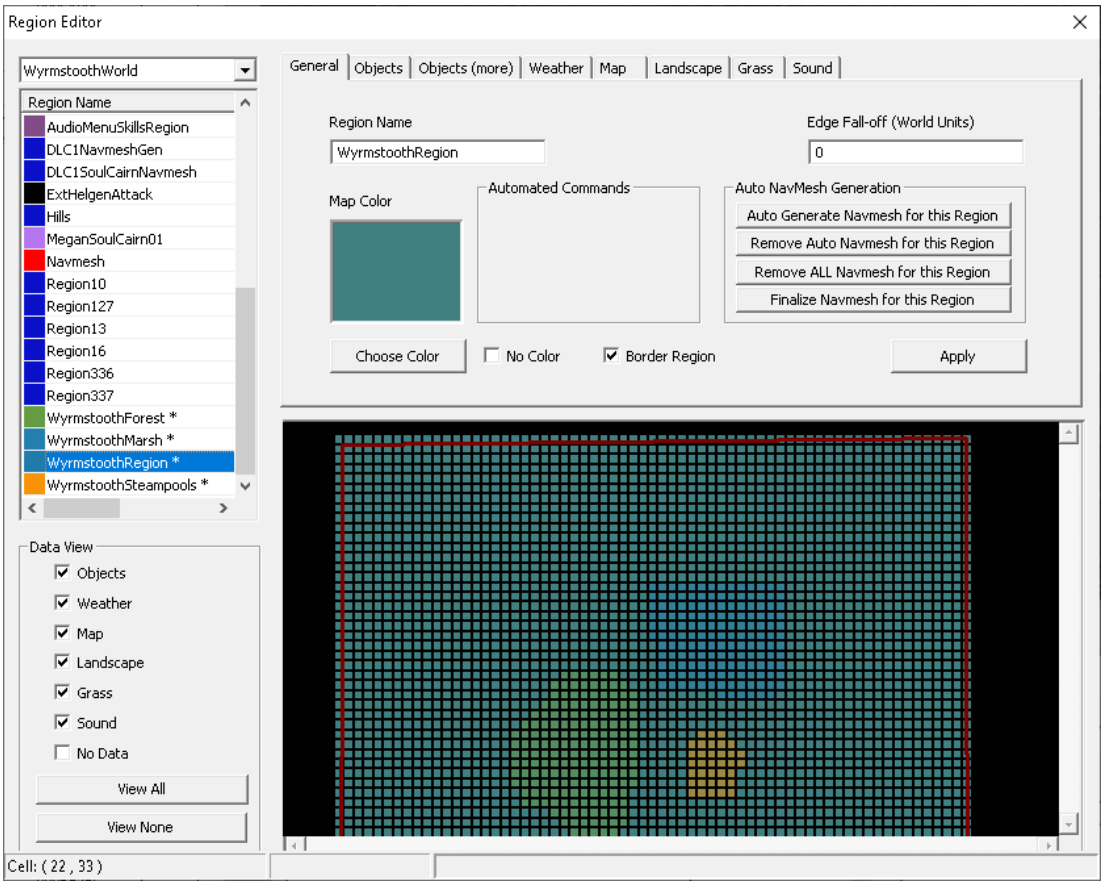

Figure 157 - An example of a world space with multiple regions.

Important: Every cell in your world space should be in a region.

The size of your border region should be defined in multiples of 8. For example, -32,32 to 32,-32, or -64,64 to 64,-64 depending on how large you plan to make your world space.

Go to World > Regions.

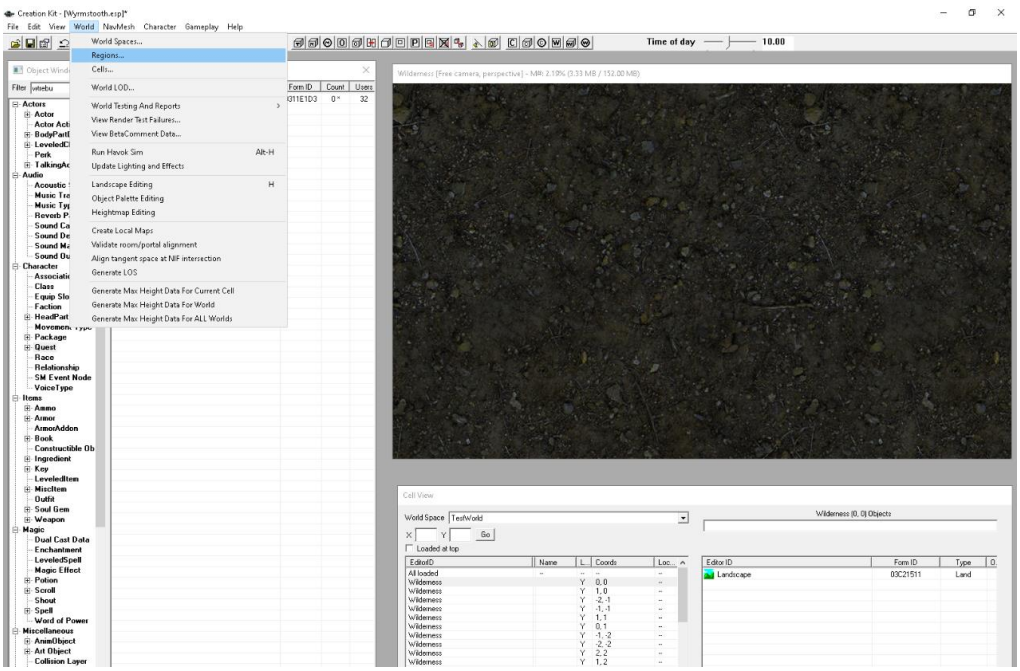

Figure 158 - Regions in the World menu.

In the drop-down at the top-left of the Region Editor, select the world space you want to create a new region for.

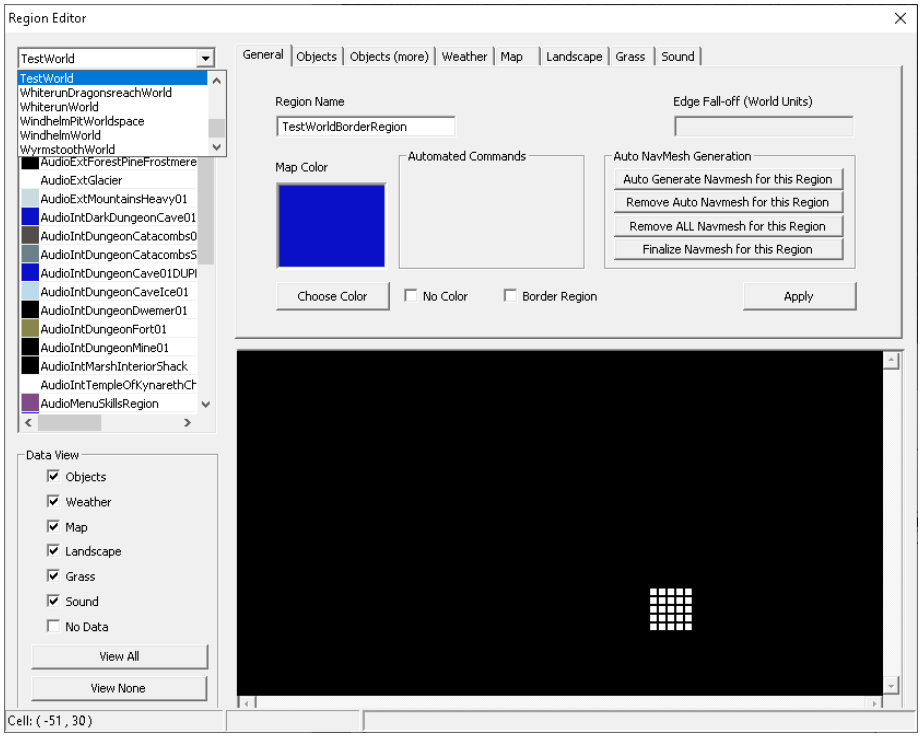

Figure 159 - Selecting the world space in the Region Editor.

Right-click on one of the regions listed and select New Region.

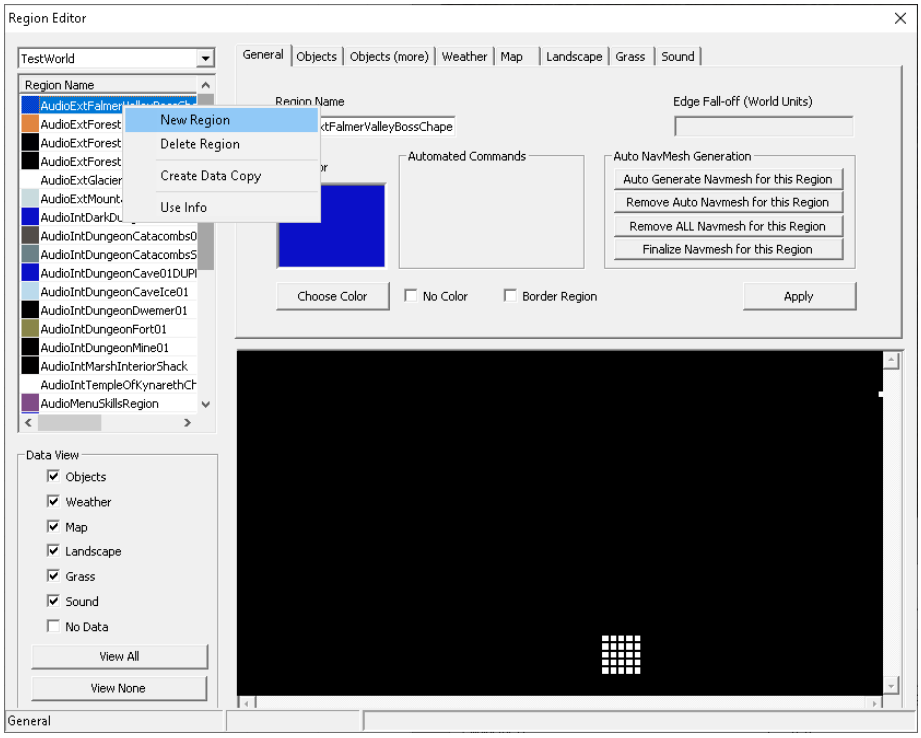

Figure 160 - Creating a new region in the Region Editor.

Under the General tab, enter a Region Name.

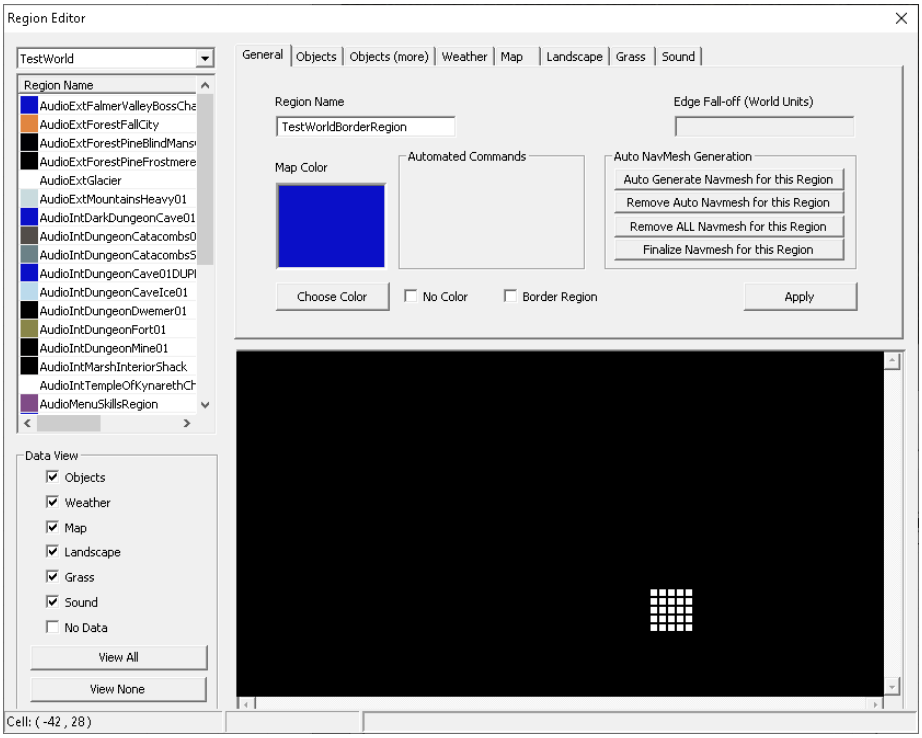

Figure 161 - Naming the new region.

Below the cell properties is the cell view. The white squares represent existing cells the Creation Kit has already created automatically when you loaded your world space in the render window. The black squares represent sections of your world space for which no cell has yet been generated.

We'll need to create a world space sized in a multiple of 8 for the sake of later on generating our land LOD, so let's start by defining a border region.

You can pan around the cell view by holding down the Spacebar while moving your mouse around. The cell you're currently hovered over will be shown at the bottom left.

In the black area, find cell -32,32 and left click. You should see a small 'x' appear.

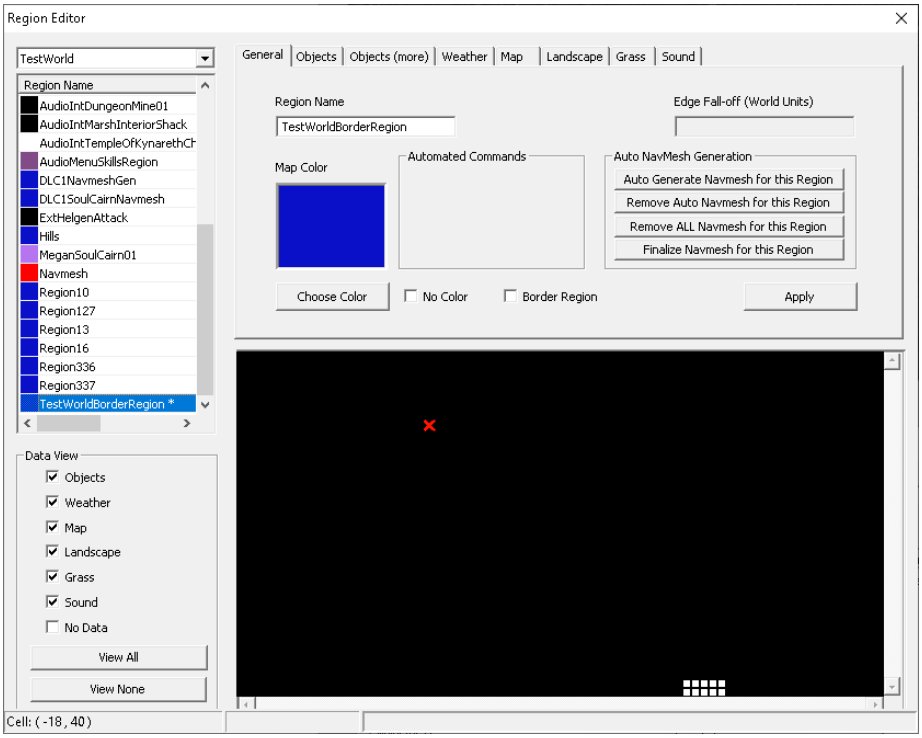

Figure 162 - Marking cell -32,32.

Next, find cell 32,32 and left-click on it to place another 'x'. A line should be drawn between the two.

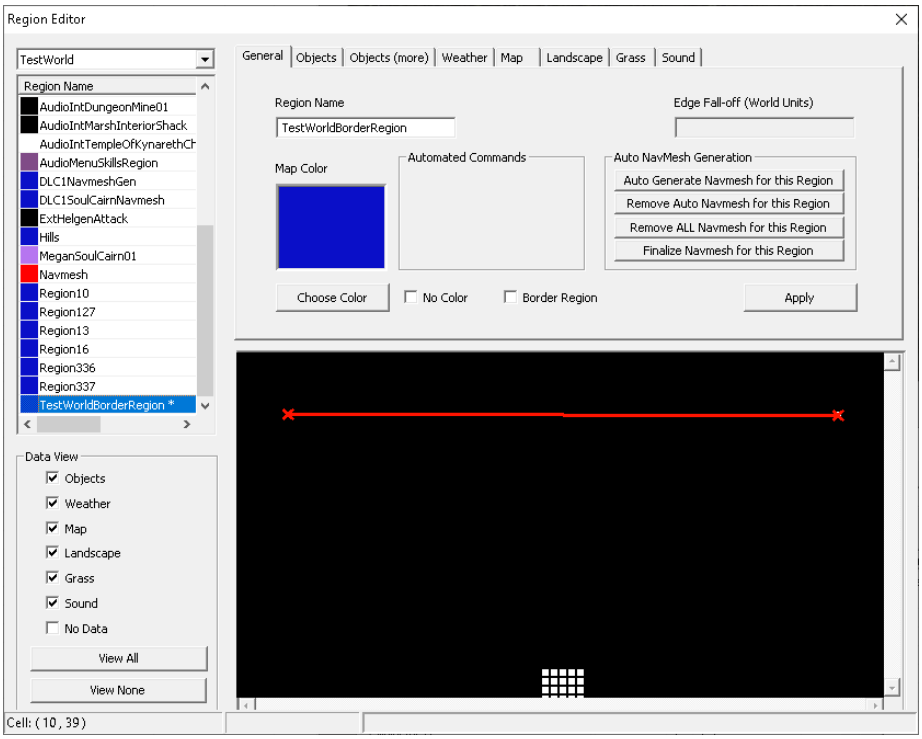

Figure 163 - Continuing the region border.

Continue down and left-click on 32,-32 then to the left and left-click on -32,-32. Finally, to close our square, left-click once again on -32,32.

Click Apply. To refresh the view, click on another region in the list then go back to your region. The cell view should now show new cells generated in-between the points we defined.

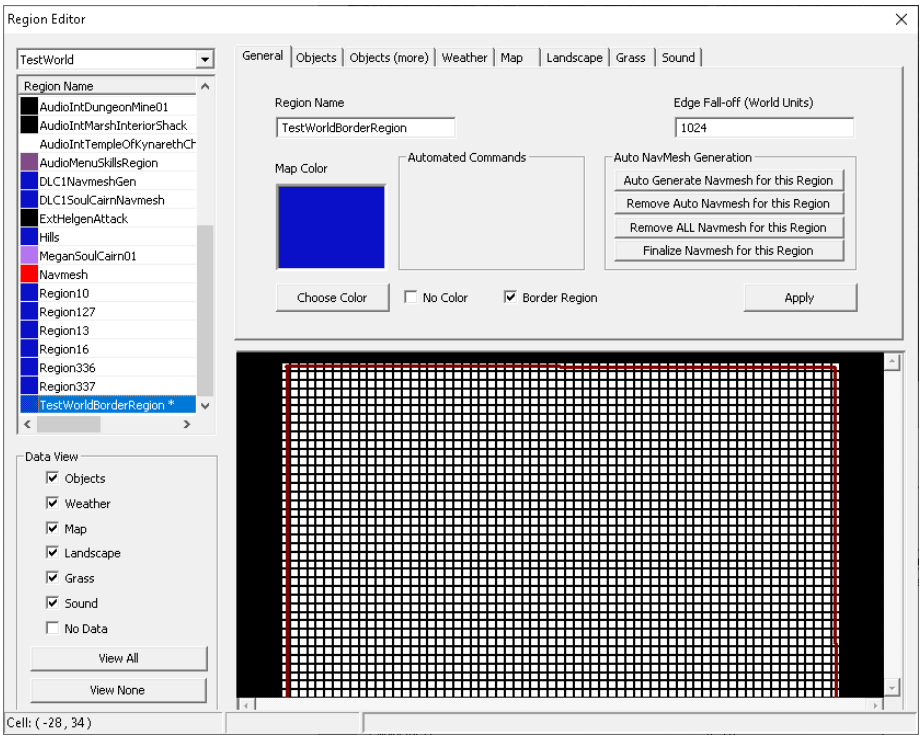

Figure 164 - New cells created within the defined border.

Click on the Border Region tickbox to mark this region as a border region.

Click Choose Colour and give your region a colour to differentiate it from other regions we'll be adding.

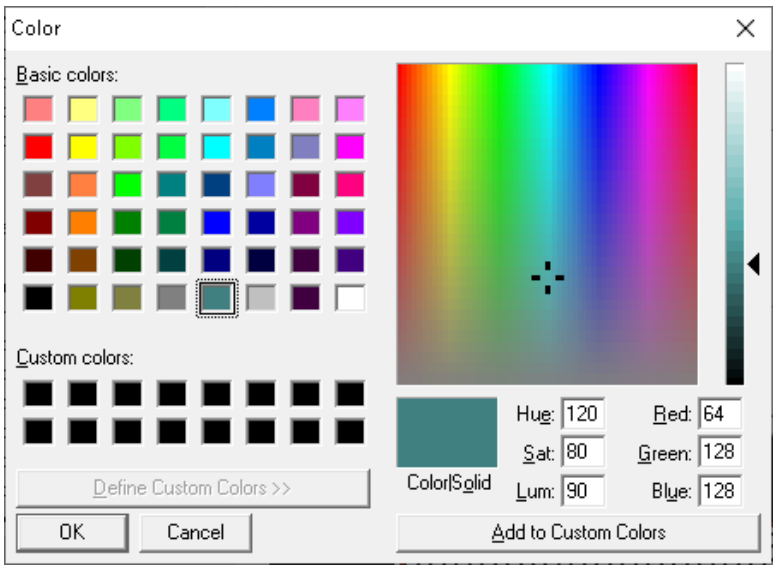

Figure 165 - Region colour.

Go to the Weather tab and tick 'Enable this type of data'.

If your region is nested within another region, tick 'Override'. Since we're working on a border region it isn't necessary.

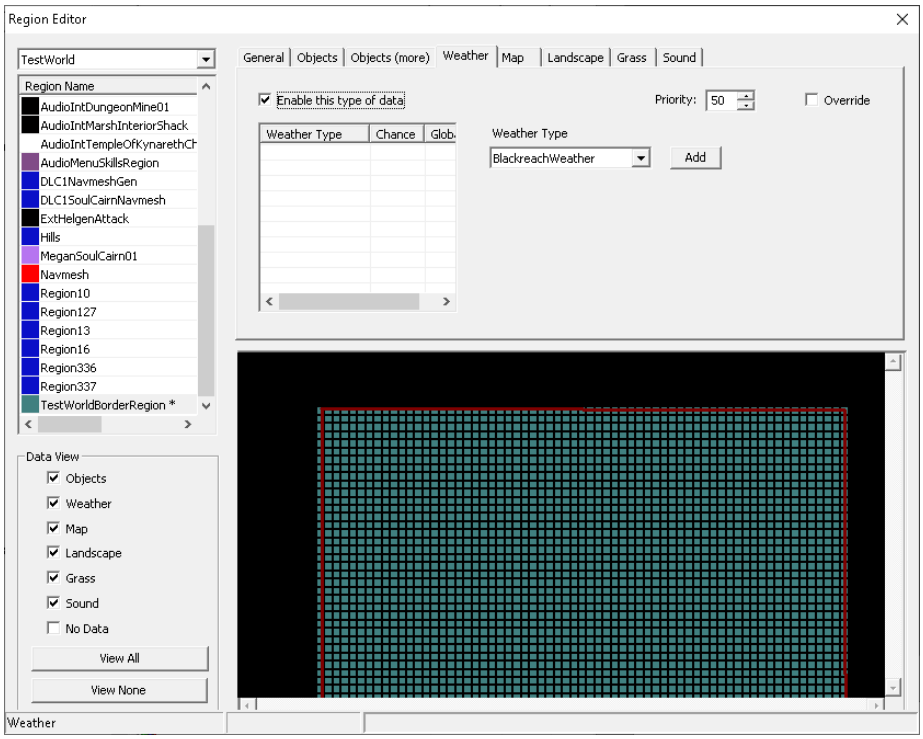

Figure 166 - Enabling region-specific weather.

To start adding weather types, choose the Weather Type you want to add in the drop-down menu and click Add. For this example I'm adding SkyrimCloudy.

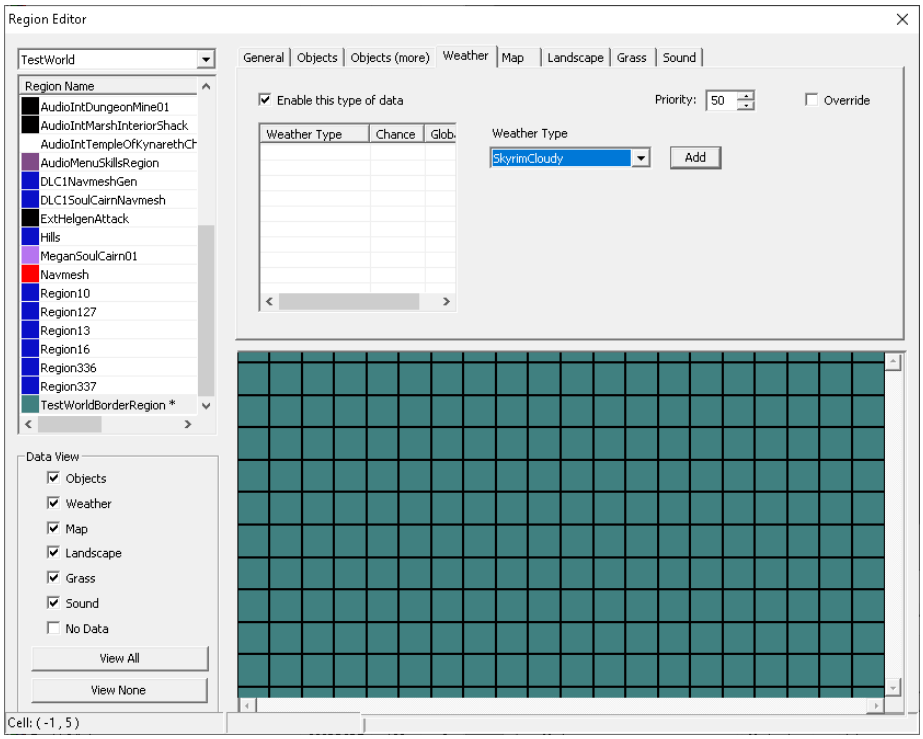

Figure 167 - SkyrimCloudy weather type selected.

When you add a weather type, the Select Form window pops up. We can just close it, no need to select anything.

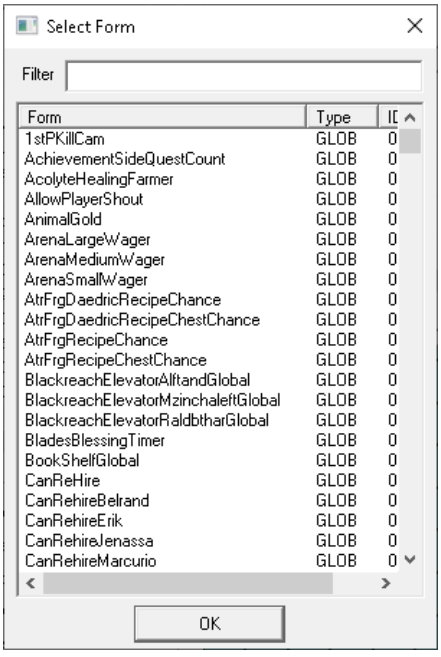

Figure 168 - Just ignore the Select Form window.

Double-click on the weather type in the list to modify its chance in the Chance column.

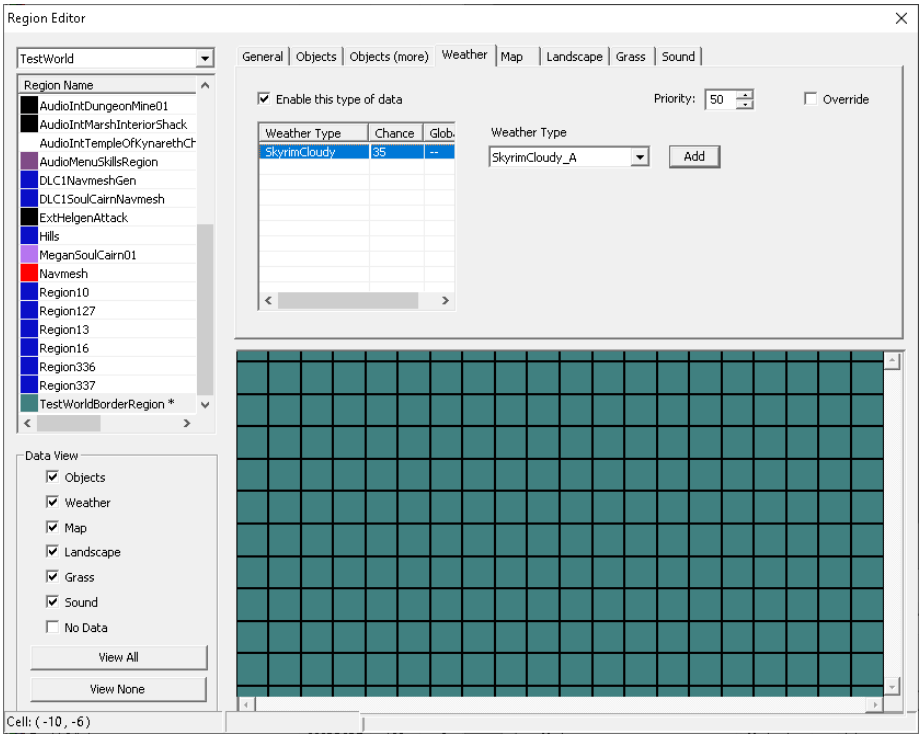

Figure 169 - Modified the chance of a specific weather's regional occurrence.

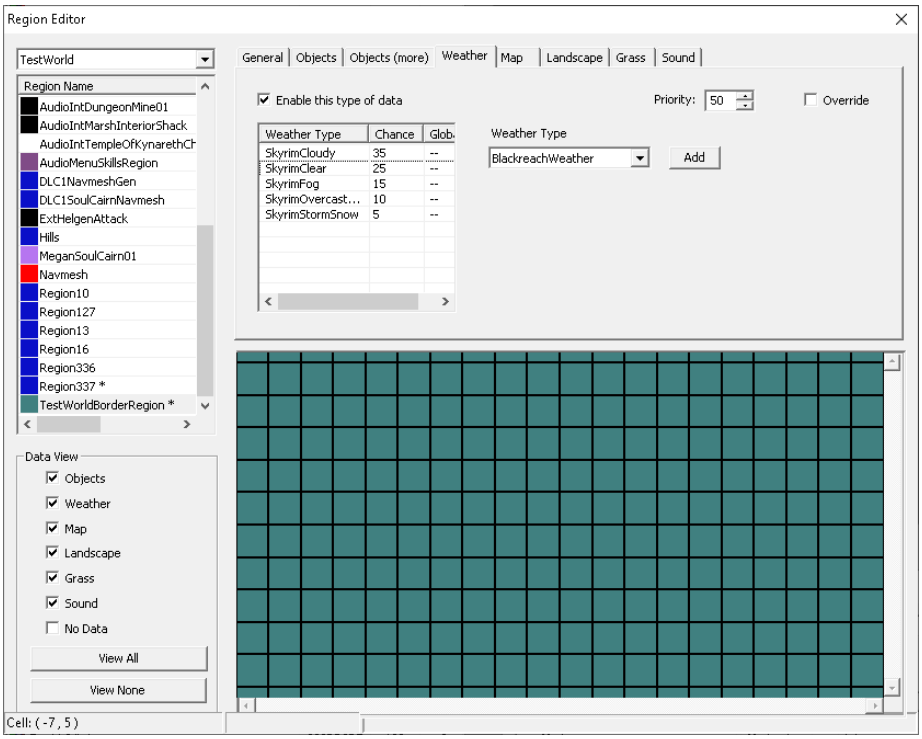

Figure 170 - Added more weather types.

Go to the Sound tab and tick 'Enable this type of data'.

Note: If your region is nested within another region that already has sound data enabled, the 'Enable this type of data' tickbox should already be ticked but will appear greyed out as per the screenshot below.

To add new sounds, in the Object Window navigate to Audio > Sound Descriptor and search for the sound you want to add, such as AMBrWindForestPineGustB01, then drag-and-drop it into the sound list in the Region Editor.

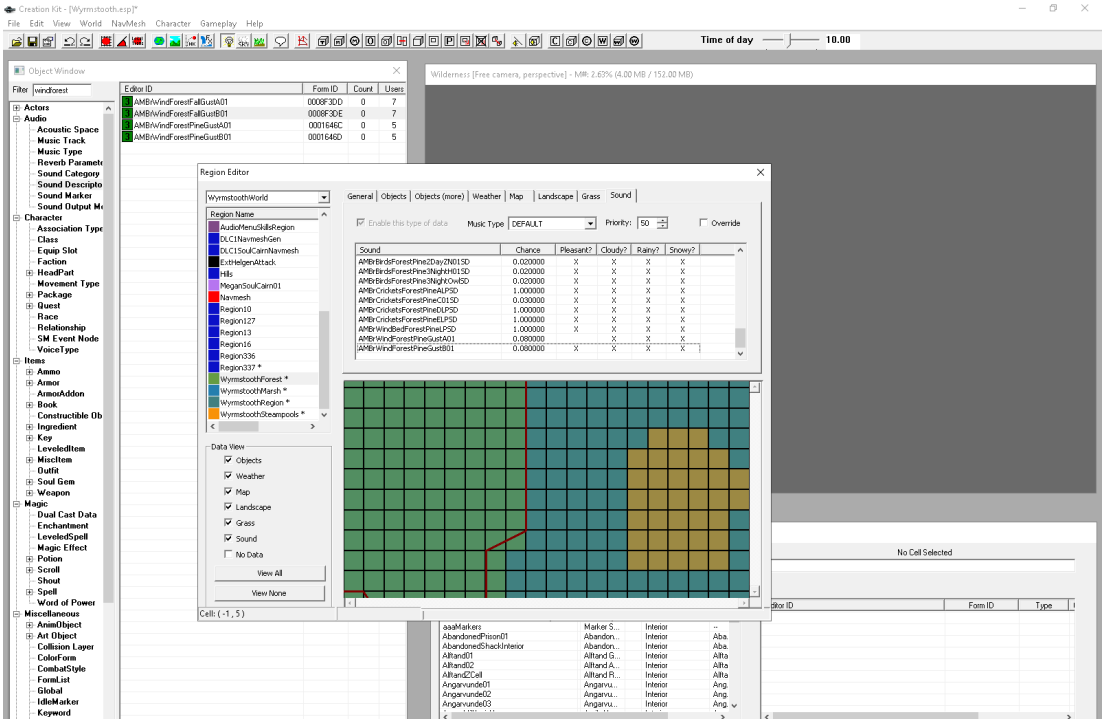

Figure 171 - Adding regional ambient sounds.

The screenshot above shows the list of sounds I added to the WyrmstoothForest region.

You can modify the chance of hearing a sound by double-clicking on its chance value to bring up the following form:

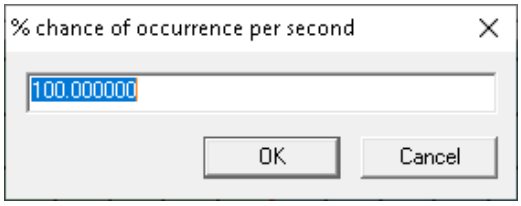

Figure 172 - Modifying the chance of hearing a sound.

Similarly, you can mute certain sounds during specific types of weathers by double-clicking on the 'X' in the corresponding column to make it disappear. For example, in the screenshot above I had muted the AMBrWindForestPineGustA01 sound during pleasant weather. Otherwise, during other types of weather, it has an 8% chance of being played each second.

Next, go to the Map tab and tick 'Enable this type of data'.

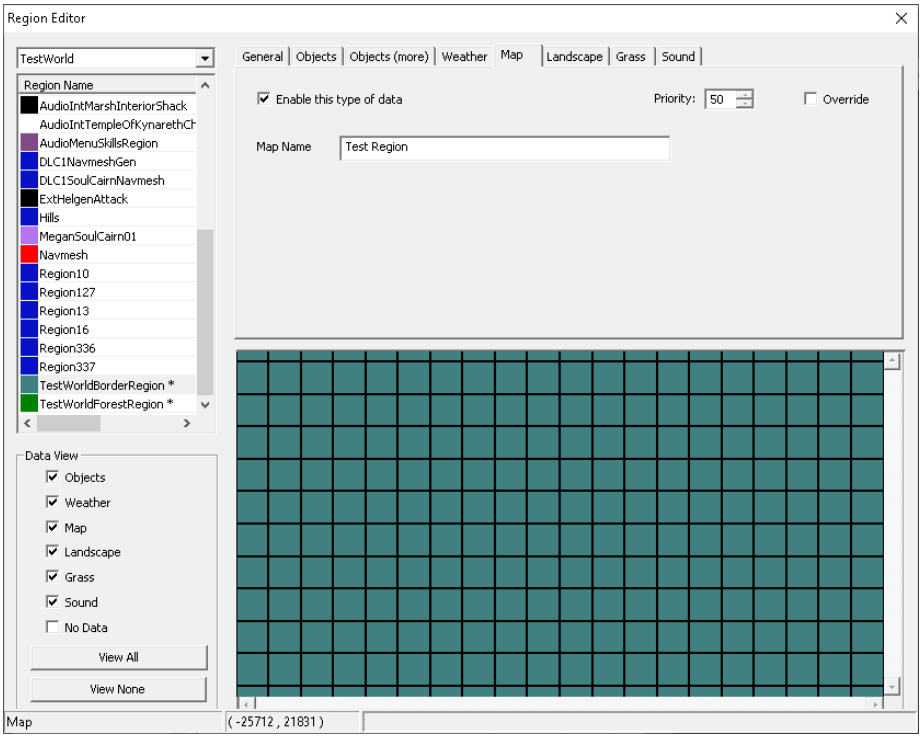

Figure 173 - Region map name for save files.

For the Map Name field, enter in the name of the region. The Map Name defined here will be shown when loading a save in the load save menu if you saved in a wilderness cell.

Let's create another new region. For this example I just called it TestWorldForestRegion.

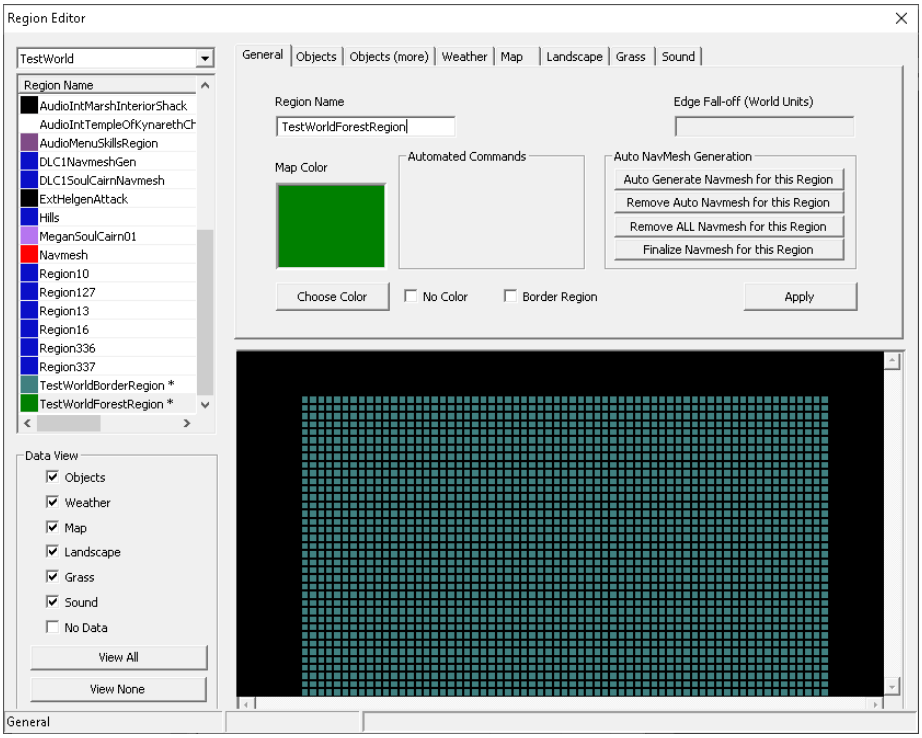

Figure 174 - Added a second region.

Draw the region borders for the new region in the cell view. Make sure it's a closed shape.

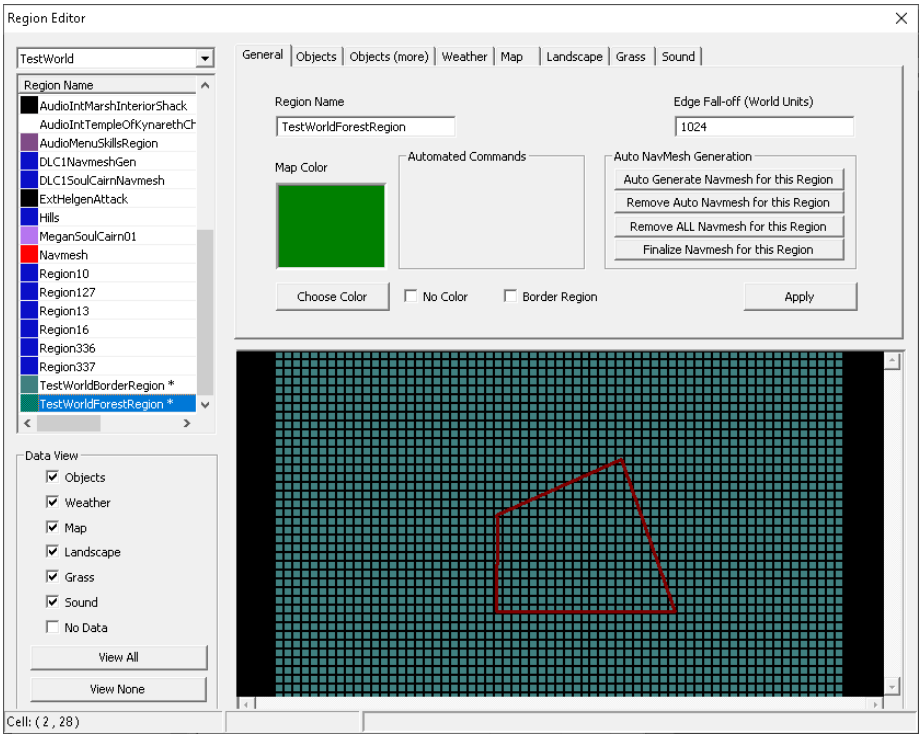

Figure 175 - Drew the border of the second region.

Go to the Weather tab. Add the weather types you want this region to experience and enter in their % chances.

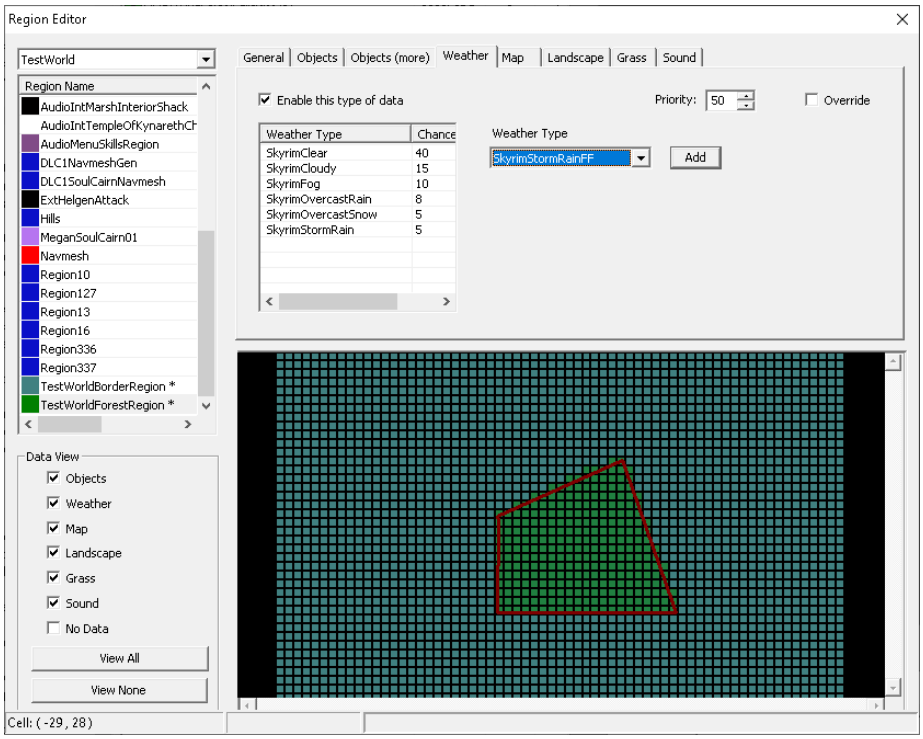

Figure 176 - Cells assigned to the new region.

The cells within the border of the new region should change colour.

You can add extra points to the shape of the region border by holding down CTRL and left-click dragging on the red border to add or subtract cells.

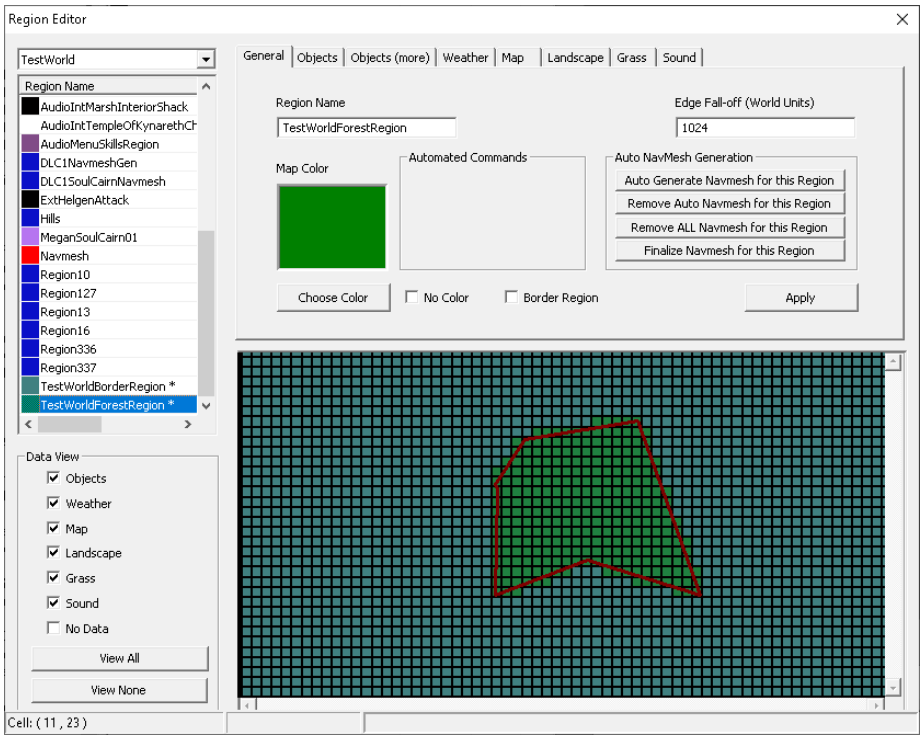

Figure 177 - Region border redrawn.

REGION GENERATED TEXTURES AND OBJECTS

Automatic texture painting and object generation is a fairly complicated topic. In this section I'm going to walk you through a few simple examples to give you enough of an idea how all of this works

The Objects and Objects (more) tabs can be used to automatically texture and/or clutter a region with objects such as trees, bushes and rocks based on conditions like slope and height. Objects and textures can be parented together to quickly form islands of detail, such as clustering small rocks around large boulders, or clustering thickets and bushes around trees.

Note: To be perfectly honest I would recommend texturing and cluttering your world space manually. Despite how tedious that sounds, you're most likely going to need to rework the positions of most of these automatically generated objects and textures. Still, you might find these steps useful as a place to start off from.

Let's have a look at auto-texturing our landscape first.

For this first example I created a small region (-4,-4 to 4, 4) and named it TestWorldAutoTexture.

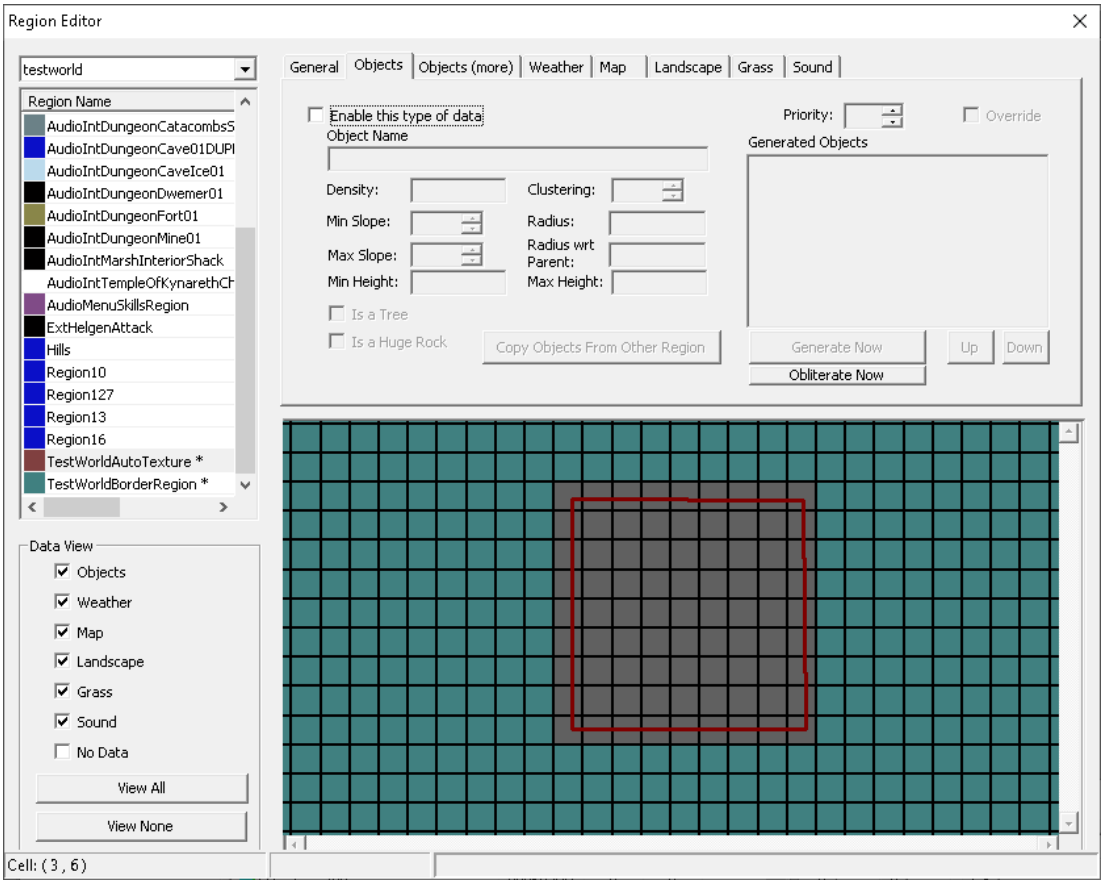

Figure 178 - TestWorldAutoTexture region.

For reference, here's what our landscape looks like without any textures applied.

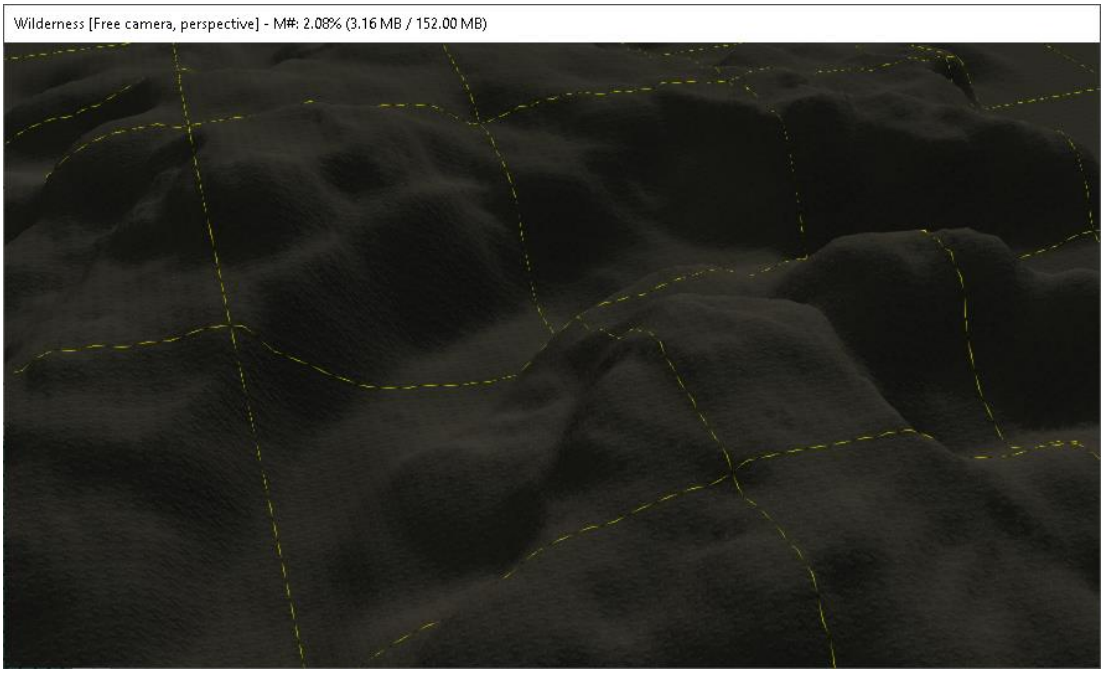

Figure 179 - Sample landscape without textures.

Go to the Objects tab and tick 'Enable this type of data'.

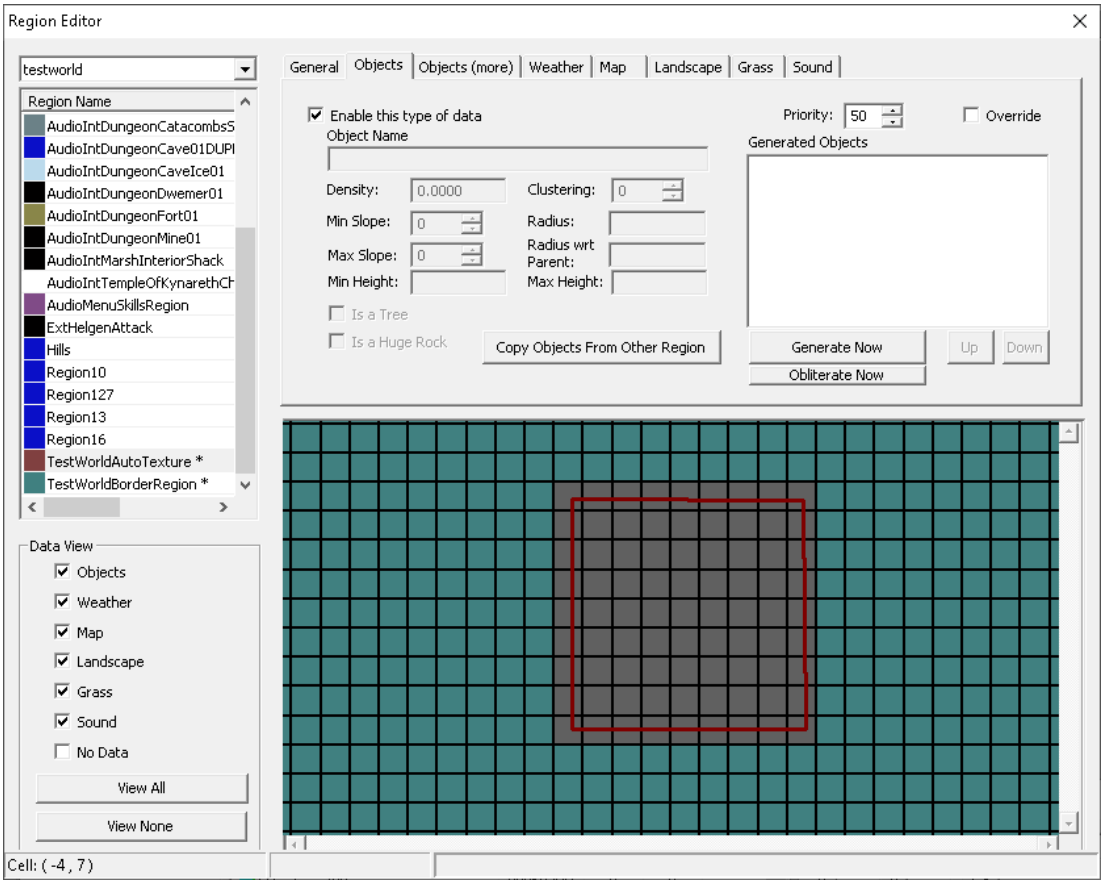

Figure 180 - Enabling object generation.

We'll get into automatic object population shortly, but for now let's concentrate on adding textures first.

In the Object Window go to Miscellaneous > LandTexture and select a texture to add to our region.

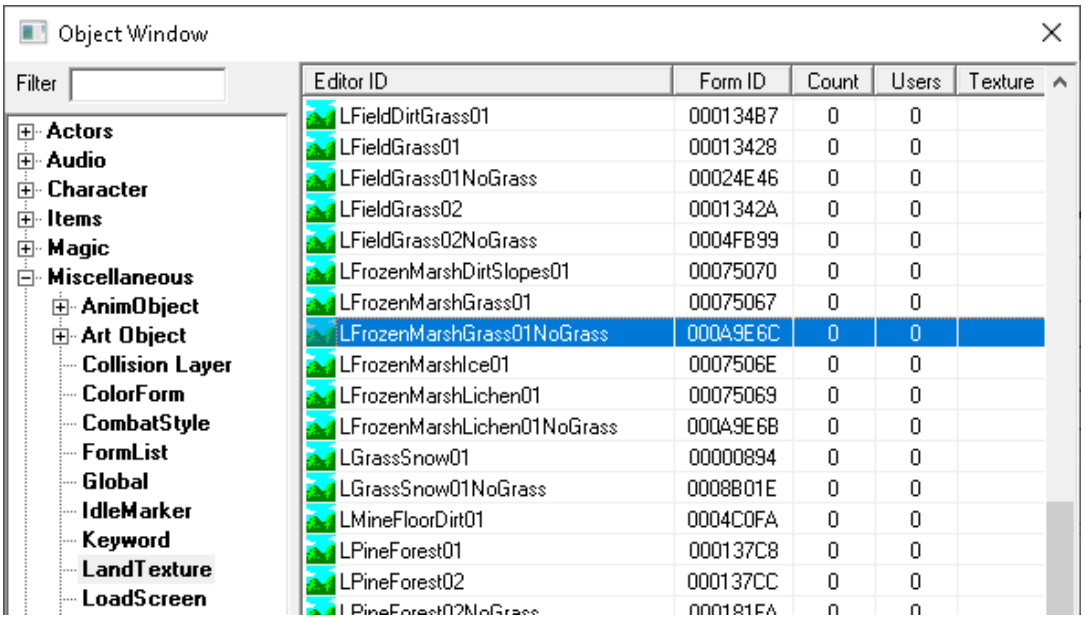

Figure 181 - Selecting a texture to automatically paint on our landscape.

For this example I'm going to add LFrozenMarshGrass01NoGrass.

Drag and drop the landscape texture into the Generated Objects list in the Region Editor.

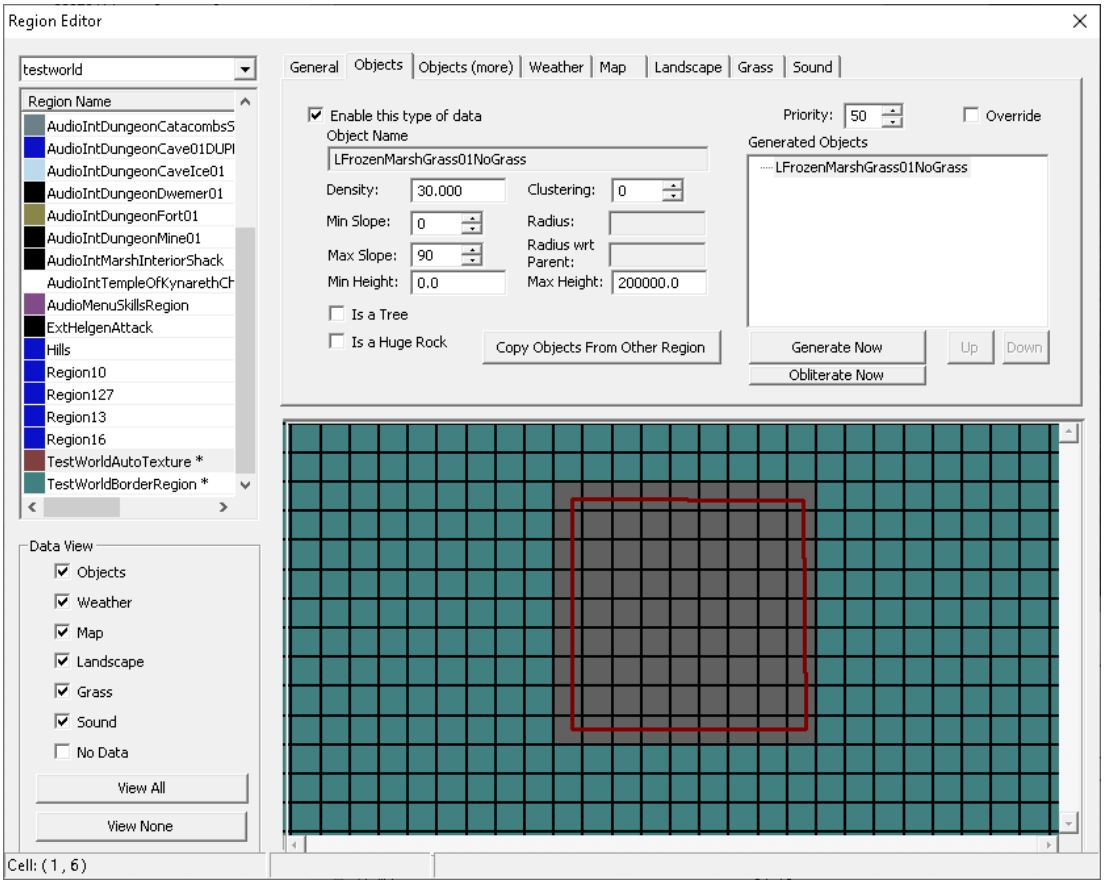

Figure 182 - Landscape texture added to Generated Objects list.

Set the Density to 80, the Max Slope to 20 and the Min Height to -200000.

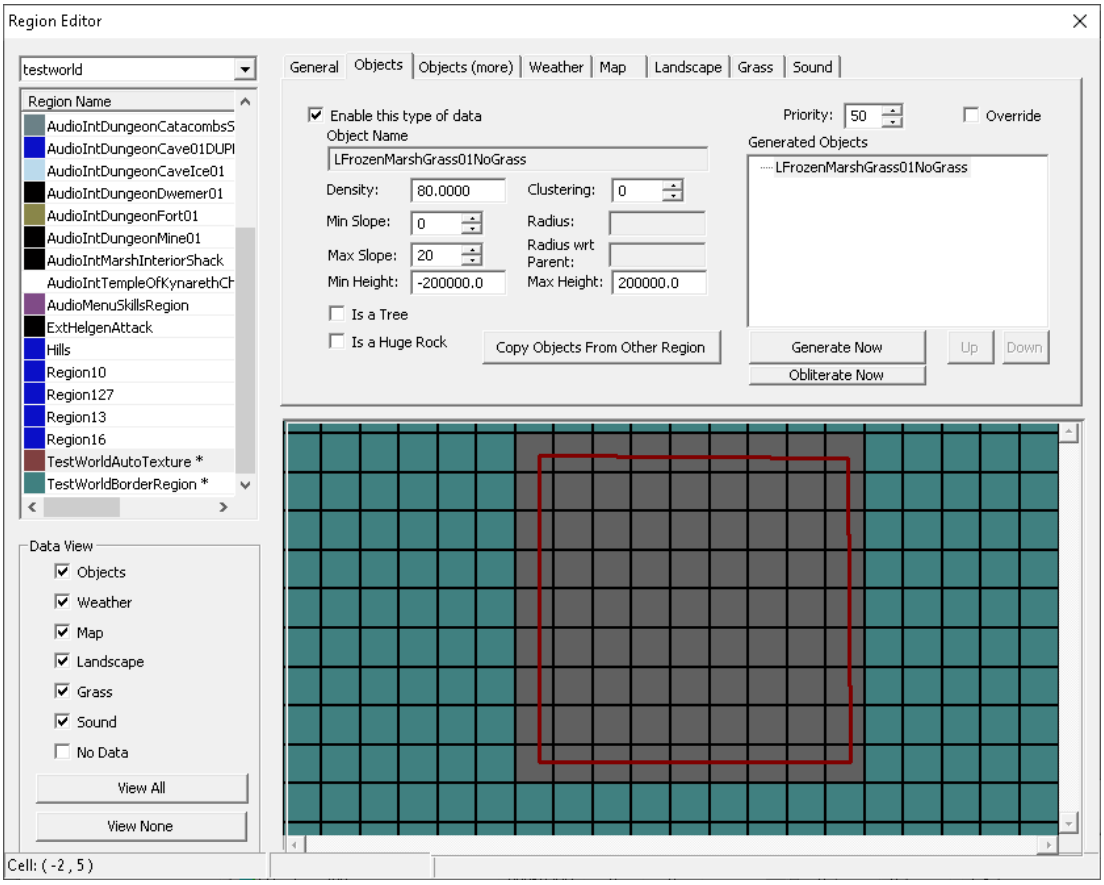

Figure 183 - Setting the generation parameters for LFrozenMarshGrass01NoGrass.

To see what this looks like so far, click on Generate Now.

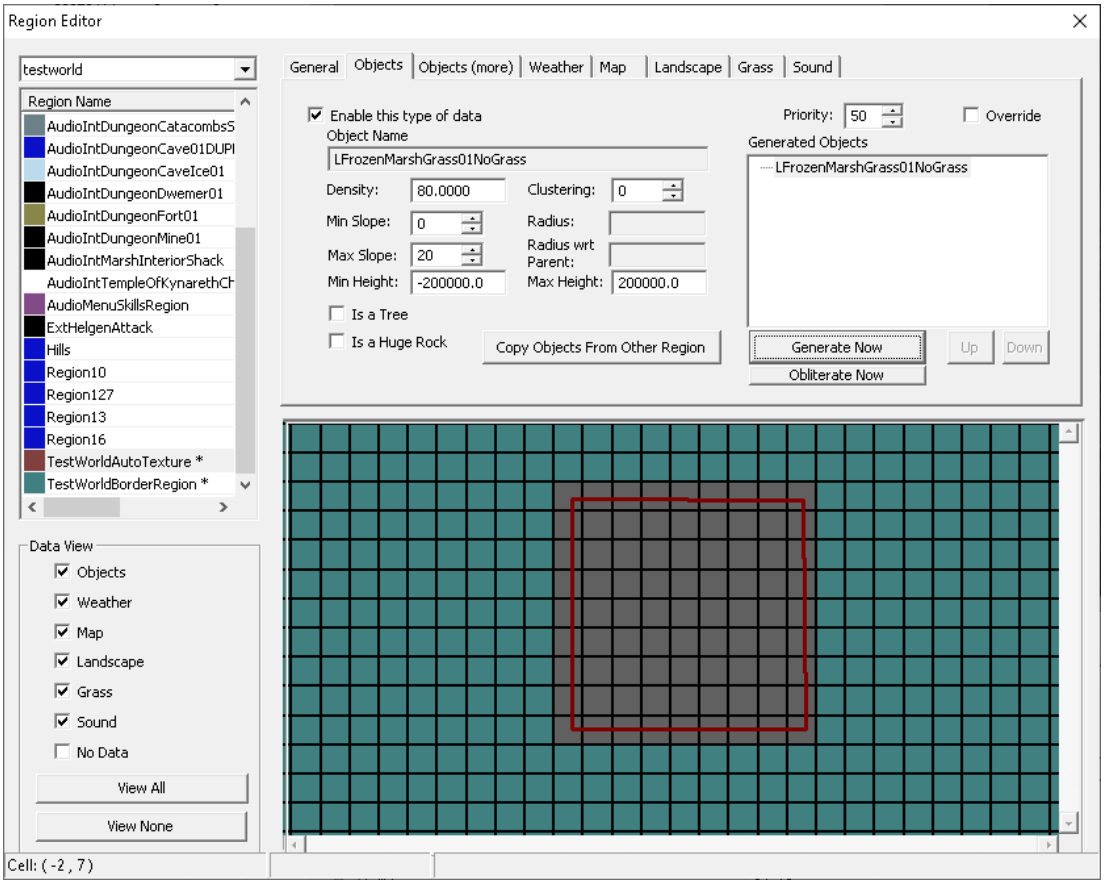

Figure 184 - Generate Now.

Click Yes to the confirmation pop-up.

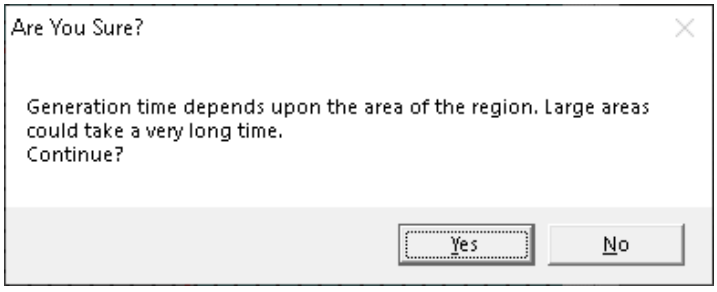

Figure 185 - Are You Sure? popup.

Click OK to the Generation Complete pop-up to dismiss it.

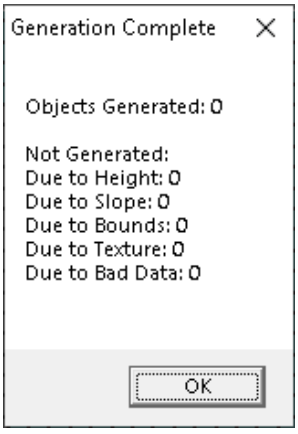

Figure 186 - Generation Complete pop-up.

Here's what our landscape looks like now:

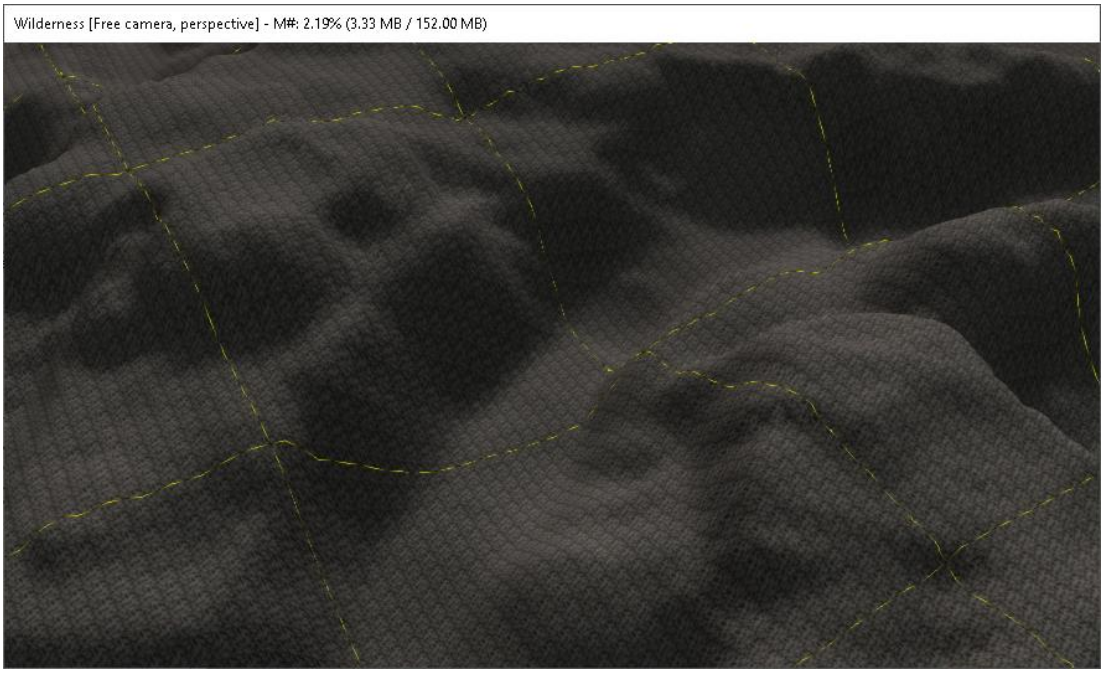

Figure 187 - Landscape automatically painted.

Despite setting a Max Slope, it looks like it painted the entire landscape. So what gives? The problem here is that we only defined one landscape texture.

If you open the Landscape Edit tool and press 'I' to look at landscape textures, you'll see what I mean.

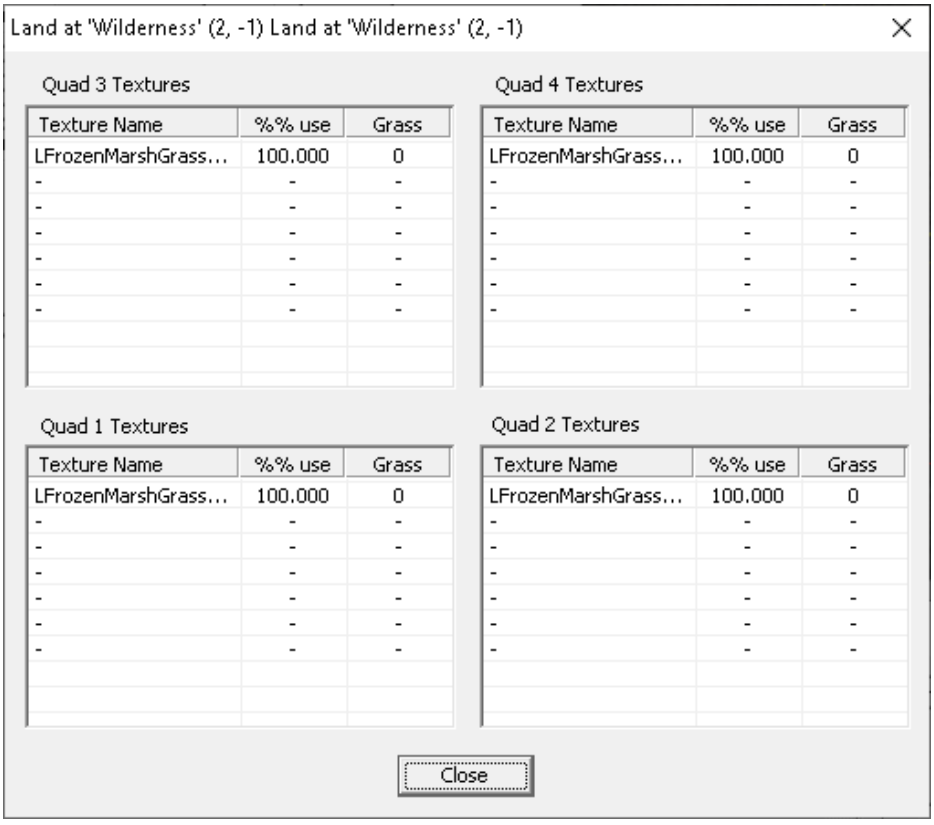

Figure 188 - Landscape textures.

LFrozenMarshGrass replaced LAND_DEFAULT, and seeing as though LAND_DEFAULT covers the entire landscape by default, LFrozenMarshGrass ended up covering the entire landscape too.

Important: Each cell needs at least one texture!

To rectify this, we need to specify a base texture that will be painted below everything.

For this example I added LDirt01. I moved it above LFrozenMarshGrass01NoGrass by highlighting it in the Generated Objects list and clicking on the Up button. I set Density to 100, Min Height to -200000 but left Max Slope at 90.

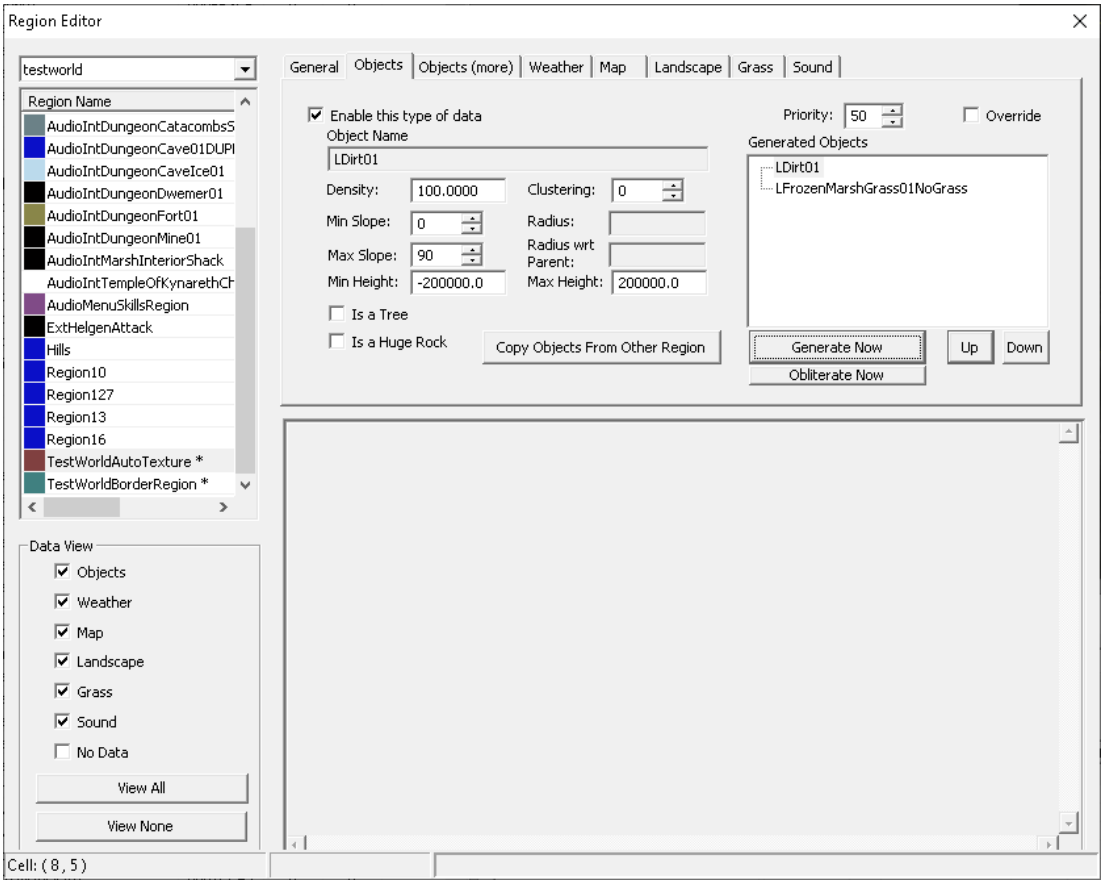

Figure 189 - LDirt01 added to Generated Objects list.

Click Generate Now again to regenerate landscape textures.

Note: The Obliterate Now button won't remove landscape textures. Landscape textures will be repainted when we click Generate Now.

Here's our landscape after adding LDirt01.

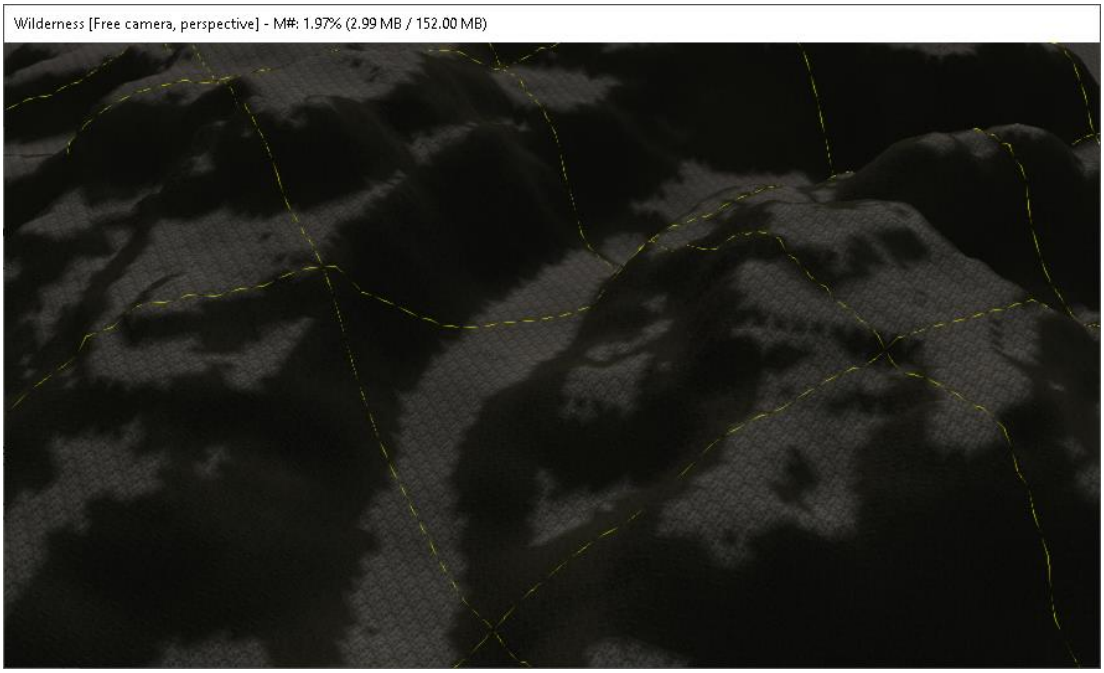

Figure 190 - Landscape after adding LDirt01.

As you can see, LDirt01 is now covering 100% of the landscape with LFrozenMarshGrass01NoGrass painted on only the flat areas.

Let's add one more texture to only the steeper slopes.

I added LRocks01NoRocks but this time set Min Slope to 40 and left Max Slope set to 90. Density was also set to 100 to ensure it covers LDirt01 on steep slopes.

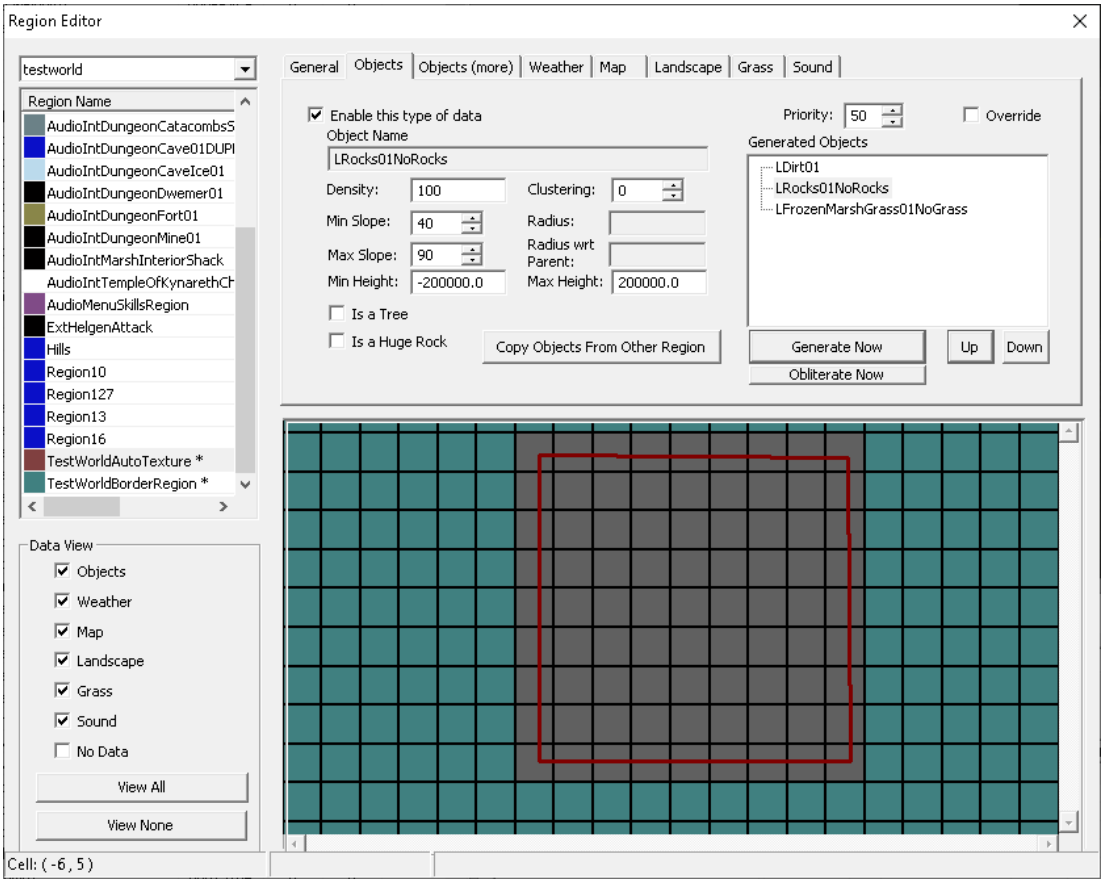

Figure 191 - LRocks01NoRocks added to Generated Objects list.

Again, click Generate Now to regenerate landscape textures.

As you can see, LRock01NoRocks was painted on the steep hill sides.

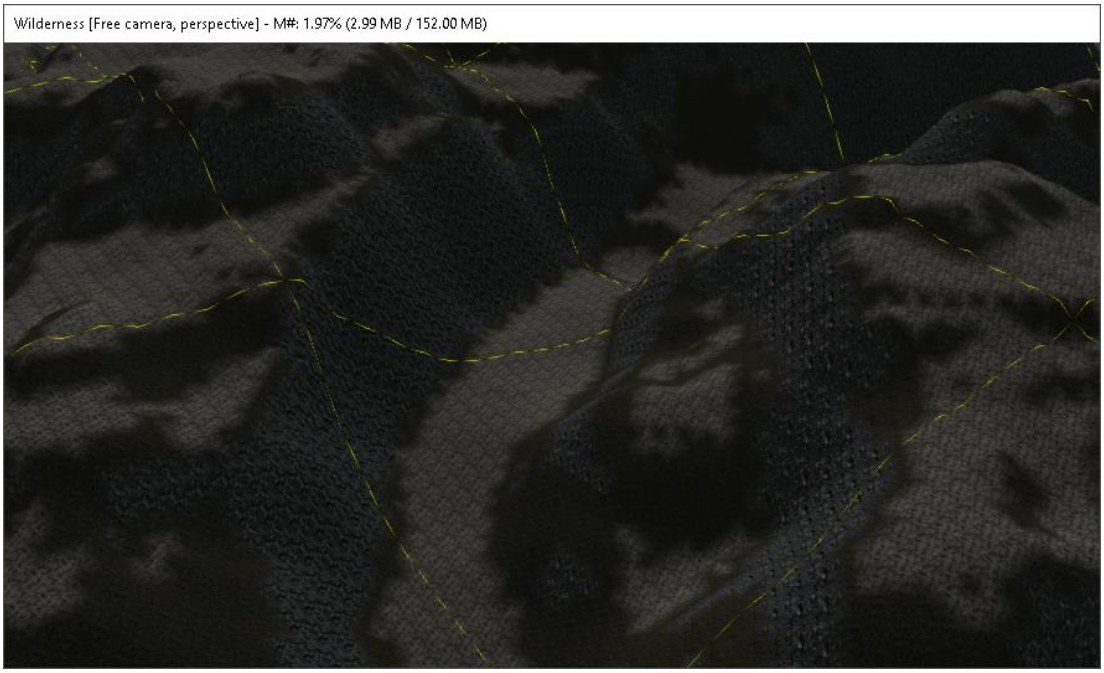

Figure 192 - Landscape after adding Rock01NoRocks.

To try and break up these textures and add some visual variety, we can add child textures by nesting them within the textures we've already added. We just need to be mindful of the number of landscape textures we've already added.

Remember: We shouldn't add more than 6 landscape textures.

If you drag and drop a new texture onto an existing texture in the Generated Objects list, it'll nest it as a child texture.

So in the following example I nested LFrozenMarshLichen01NoGrass below LFrozenMarshGrass01NoGrass, so wherever LFrozenMarshGrass01NoGrass is painted, LFrozenMarshLichen01NoGrass will have a chance to be painted as well.

To ensure it doesn't completely overwrite the parent texture, I reduced its density to 50 but kept the same Min Slope and Max Slope values as the parent.

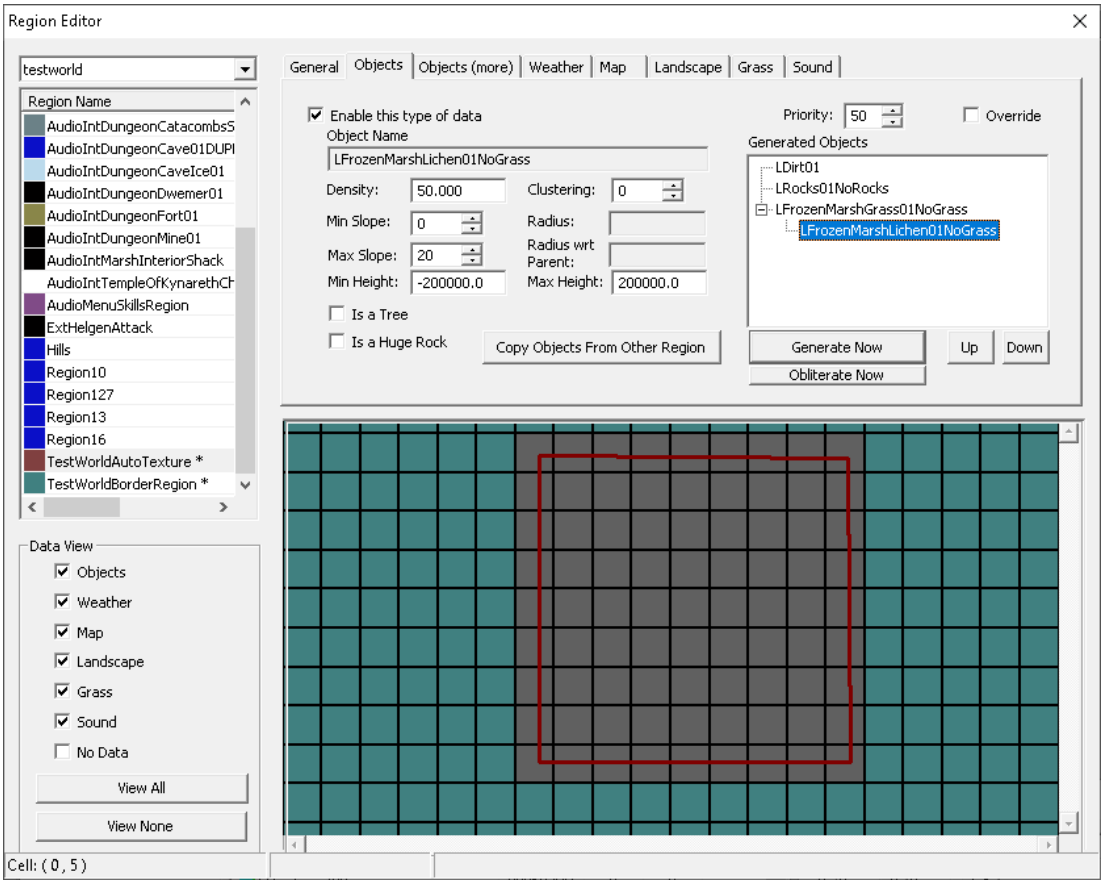

Figure 193 - LfrozenMarshLIchen01NoGrass added to Generated Objects.

And here's our end result:

Figure 194 - LfrozenMarshLichen01NoGrass blended with LFrozenMarshGrass01NoGrass.

As you can see, LFrozenMarshLichen01NoGrass is being painted over LFrozenMarshGrass01NoGrass, blending with the parent texture.

To paint the child texture in a blotchier manner, we can increase the Clustering value.

In the following example I increased Clustering to 50.

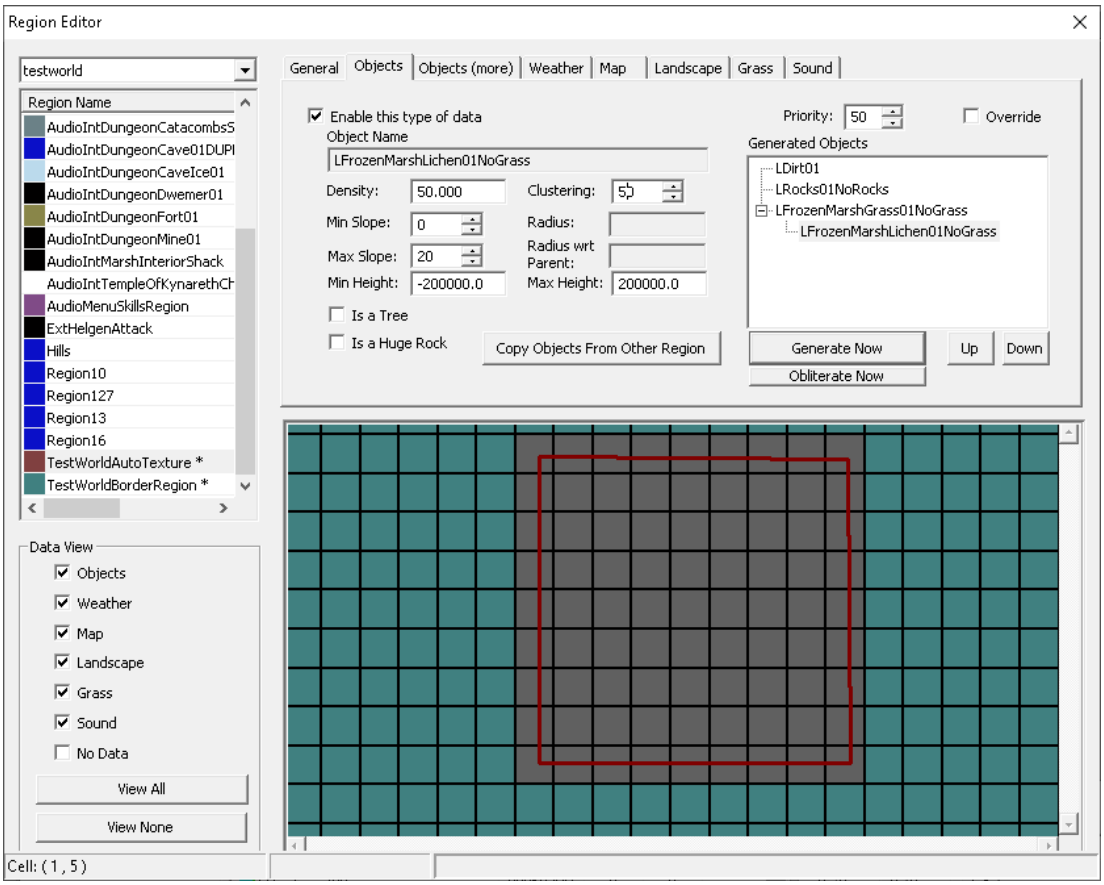

Figure 195 - Increasing the Clustering value.

As you can see, LFrozenMarshLichen01NoGrass is now spread around more randomly.

Figure 196 - LfrozenMarshLichen01NoGrass with Clustering set to 50.

We can think of increasing the Clustering value as being the same as reducing the size of a random noise mask. The higher the value the noisier the distribution of the texture will be.

I'll be looking at how we can generate objects randomly across our sample region next.

Note: I'd recommend starting with a small region first to test out the density and distribution of auto generated objects. You can always expand that region afterwards once you're satisfied with how objects are being populated then generate again to fill a wider area.

In the Object Window, go to WorldObjects > Static.

For this example I'm going to start by dragging and dropping RockL01, RockL02 and RockL03 into the Generated Objects list in the Region Editor.

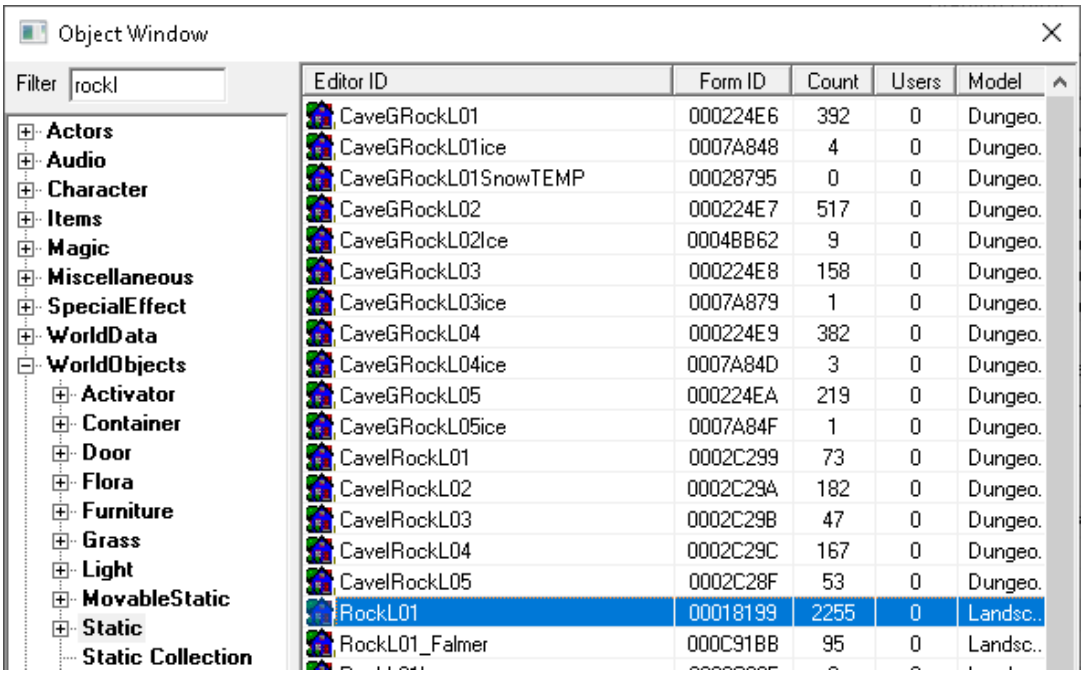

Figure 197 - Static rocks.

For each rock, set Min Height to -200000, tick 'Is a Huge Rock' then click on Generate Now.

Note: 'Is a Huge Rock' will allow smaller objects to be populated on top of it.

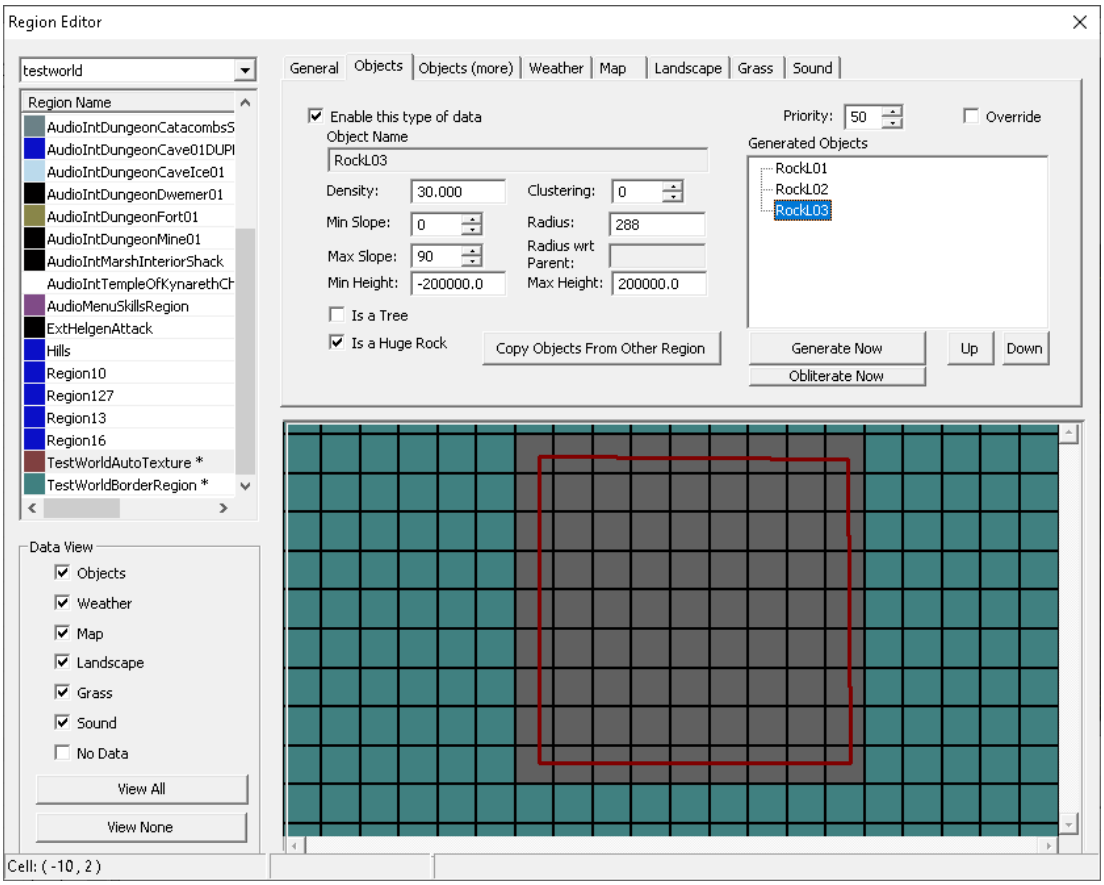

Figure 198 - Populating the region with three different types of rock.

Click 'Yes' to the confirmation pop-up.

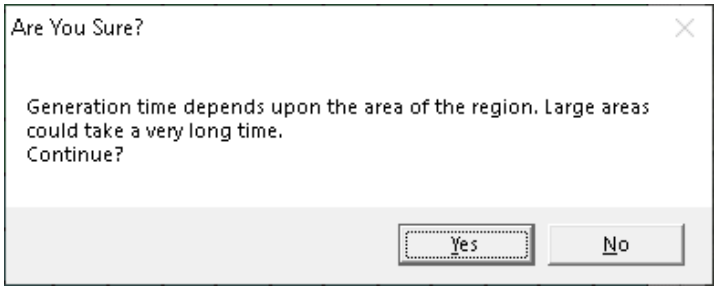

Figure 199 - Auto generate confirmation.

Here's what our distribution looks like with these default settings:

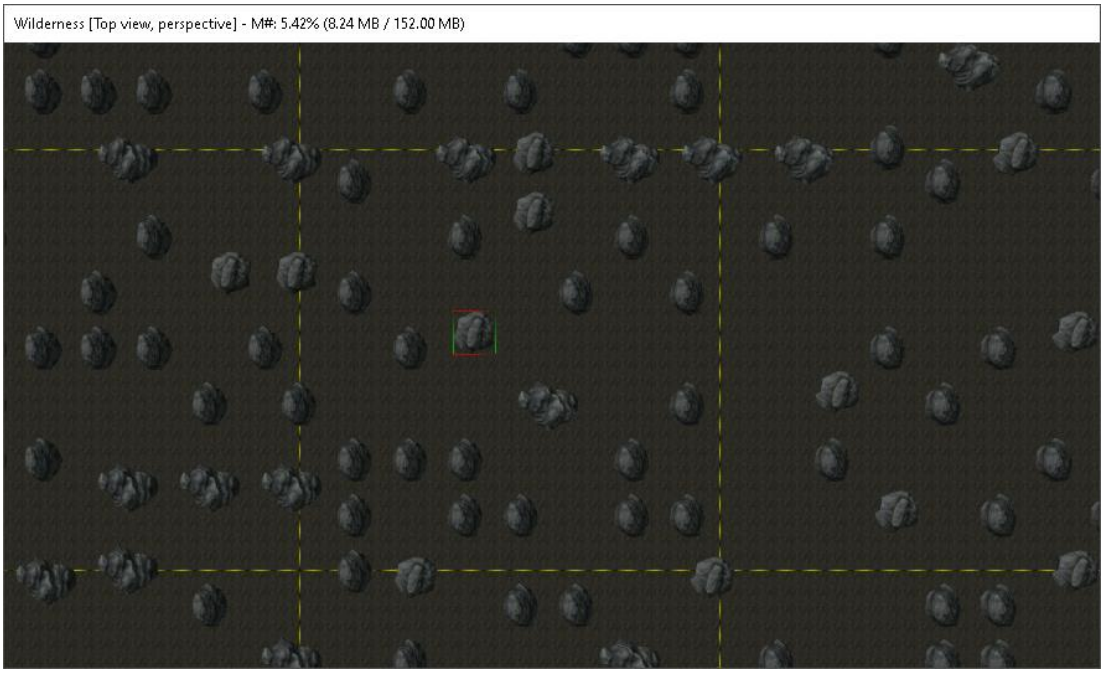

Figure 200 - Object distribution.

You'll notice that all the objects are facing the same direction. We'll fix this shortly but for now let's take a look at the different ways we can control the distribution of objects in the region.

Click Obliterate Now to remove the objects generated in this region. Click 'Yes' to the confirmation pop-up.

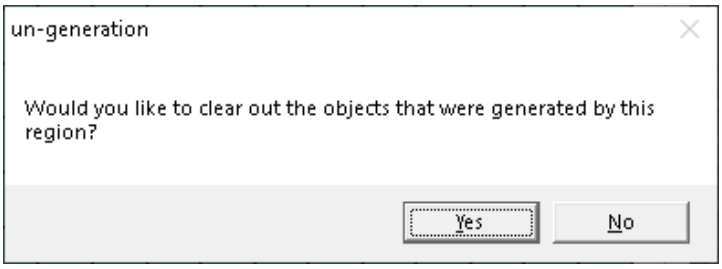

Figure 201 - Auto generate obliteration confirmation.

Let's look at increasing the Density of RockL02 next and see what that looks like. Click on RockL02 in the Generated Objects list to select it and set the Density field to 60.

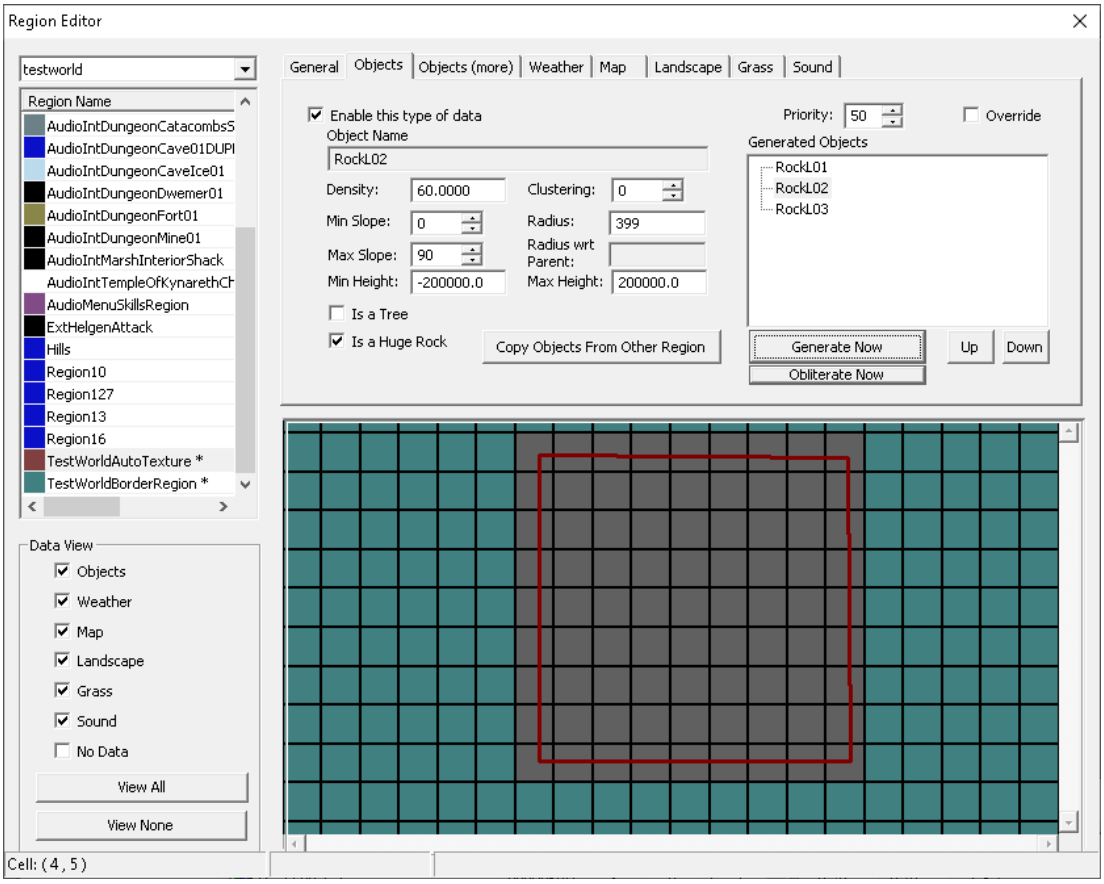

Figure 202 - Increasing RockL02 Density value.

The Radius for RockL02 by default is 399. This field determines how close this object could potentially be placed next to other instances of itself.

Reduce the Density value on RockL01 and RockL03 to 10 then click Generate Now.

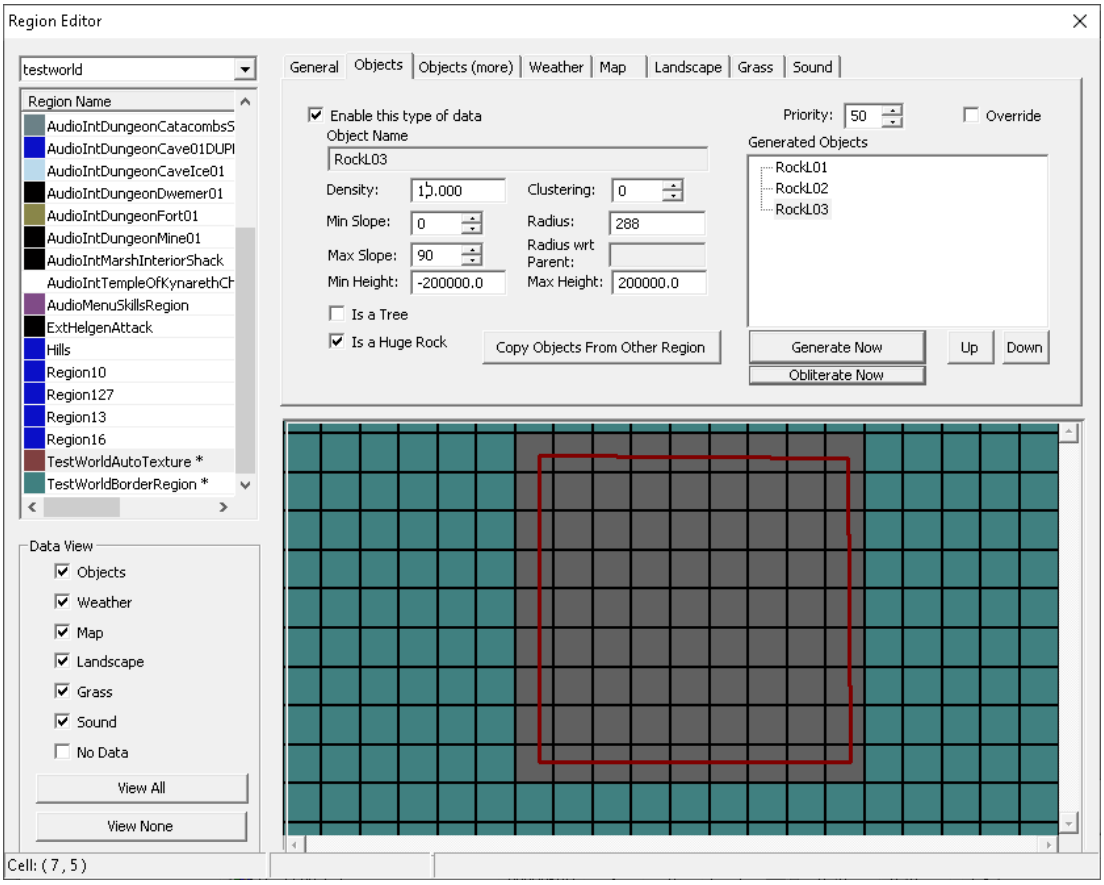

Figure 203 - Decreasing the RockL01 and RockL03 Density value.

Important: Ticking the Override tickbox will force this region's object generation settings to take precedence over the object generation settings from other regions that a cell may also be within.

As you can see there are now a lot more instances of RockL02 than RockL01 and RockL03.

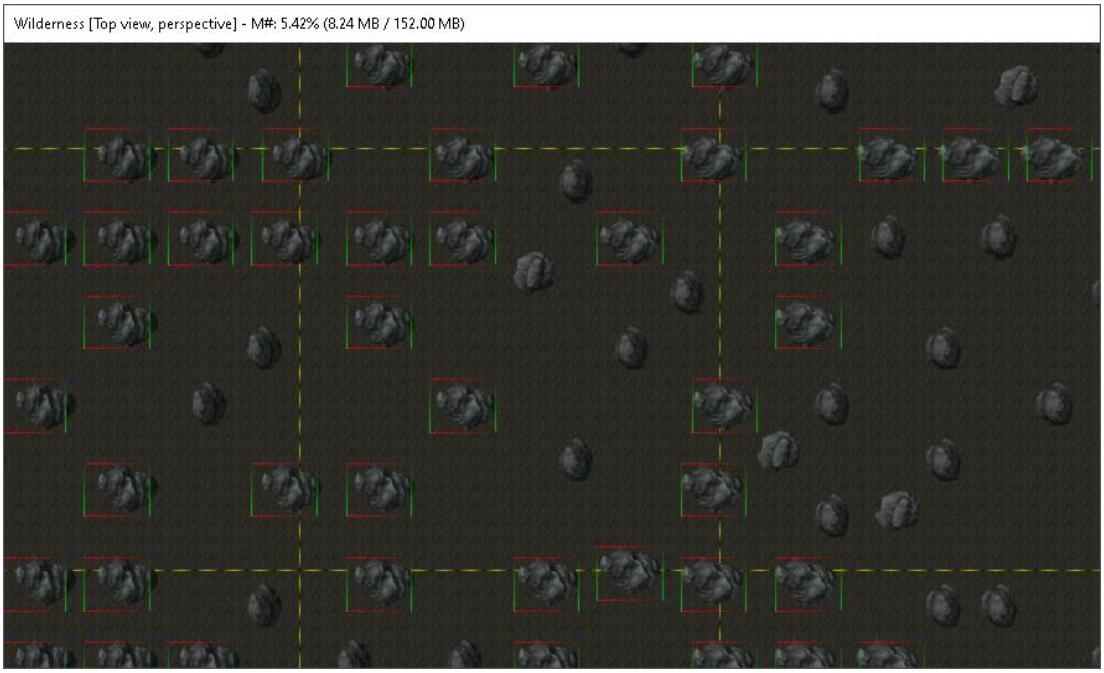

Figure 204 - More instances of RockL02.

To control the likelihood that an object will be placed close to another instance of its type, increase the Clustering value.

By default the Min Slope is set to 0, allowing an object to be placed on flat surfaces. The default Max Slope is 90 meaning the object may be generated on steep cliff faces.

Min Height controls the lowest elevation this object may be populated at. By default that's 0.0. Since our landscape is technically below the ocean surface, we need to reduce this number which is why I set it to -200000.

Similarly, Max Height controls the maximum elevation that an object can be populated at. The object won't be populated above the height set in this field. By default that will be 200000.0. If you only want an object to be generated below the ocean surface you would need to set this field to 0.0.

Next let's look at setting up child objects.

From the Object Window I'm going to drag and drop RockS01, RockS02 and RockS03 onto RockL02. For this example I'm going to remove RockL01 and RockL03 for now.

Set the Min Height on RockS01, RockS02 and RockS03 to -200000 and the Density to 10.

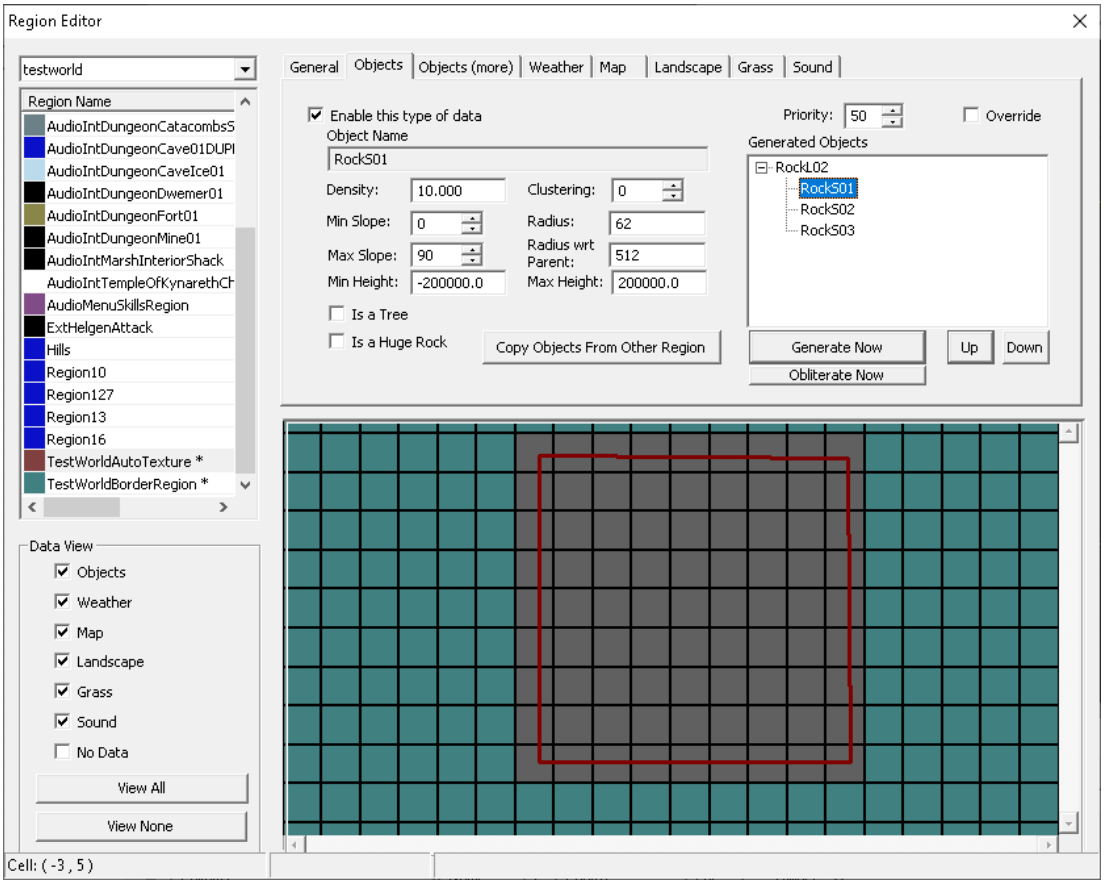

Figure 205 - Adding child objects.

To get a better idea of what's going on I'm going to reduce the Density of the parent object RockL02 to 5 before generating.

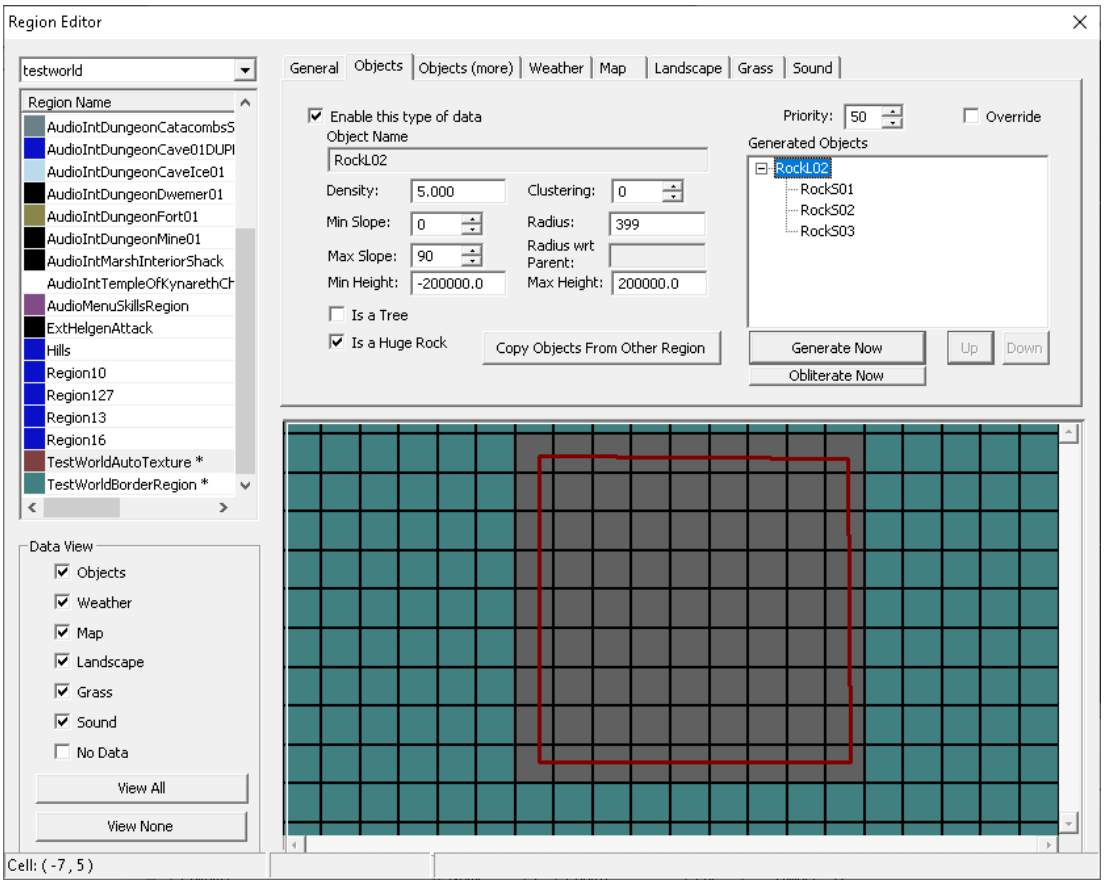

Figure 206 - Reducing the Density of RockL02.

And here's what we get. As you can see, the small rocks are being automatically populated around the large rocks.

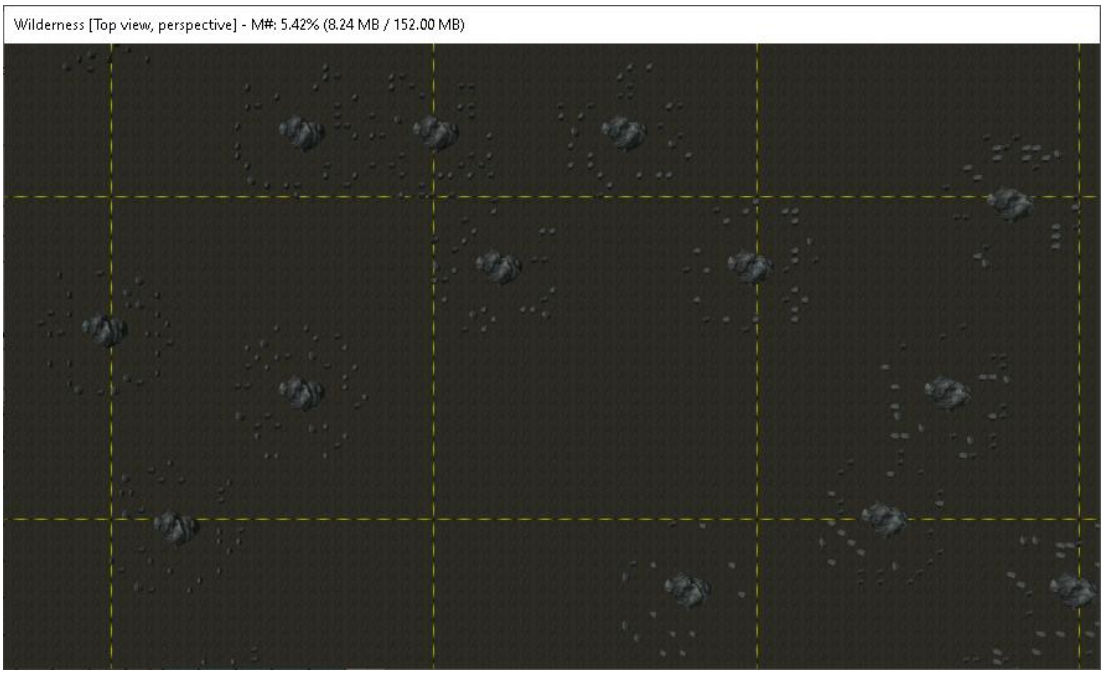

Figure 207 - Small rocks generated around the large rocks.

Radius controls the minimum distance this object can be from another instance of its type.

On the other hand, the 'Radius wrt Parent' field controls how far away from the parent the children object can be generated.

For RockS01, RockS02 and RockS03 set 'Radius wrt Parent' to 1024 then generate again.

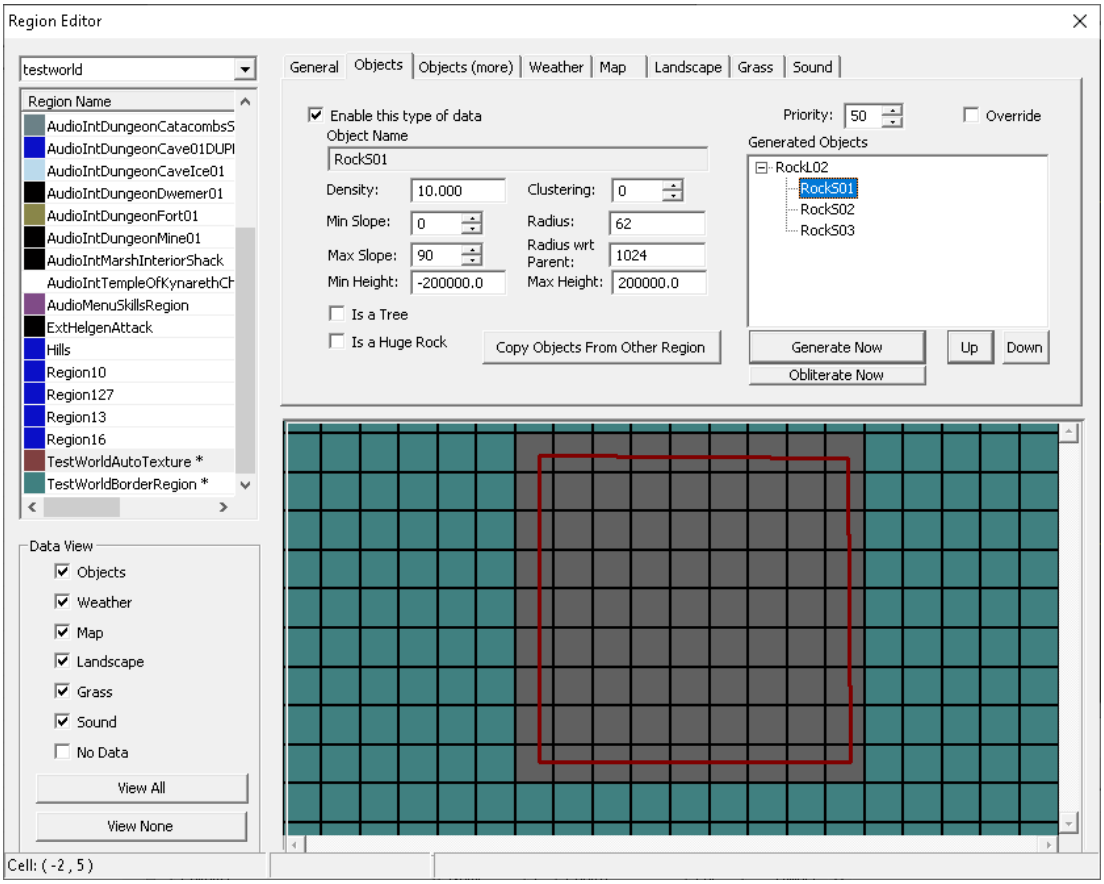

Figure 208 - Increasing the Radius wrt Parent field.

So as you can see this has increased the distance from which child objects will be generated from the parent, which has also resulted in many more child objects being generated.

Figure 209 - More child objects generated around parent.

Here's a look from a closer angle:

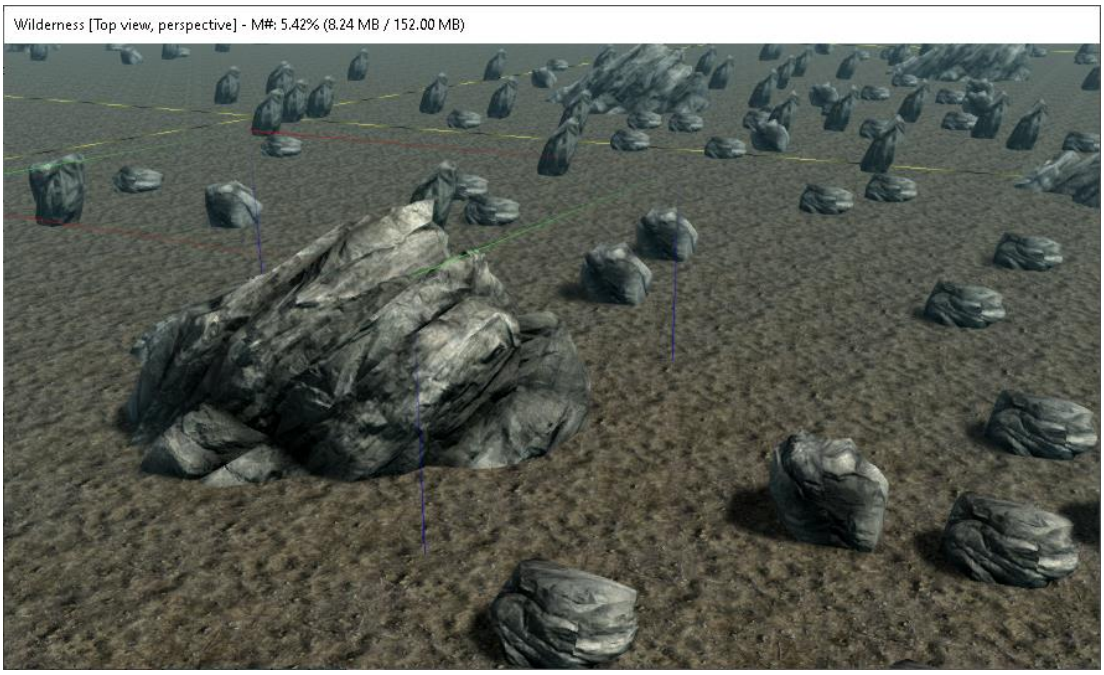

Figure 210 - A closer look at the auto generated rocks.

All these rocks look too uniform so let's do something about that next.

To add some random variance to these objects we'll need to switch over to the Objects (more) tab.

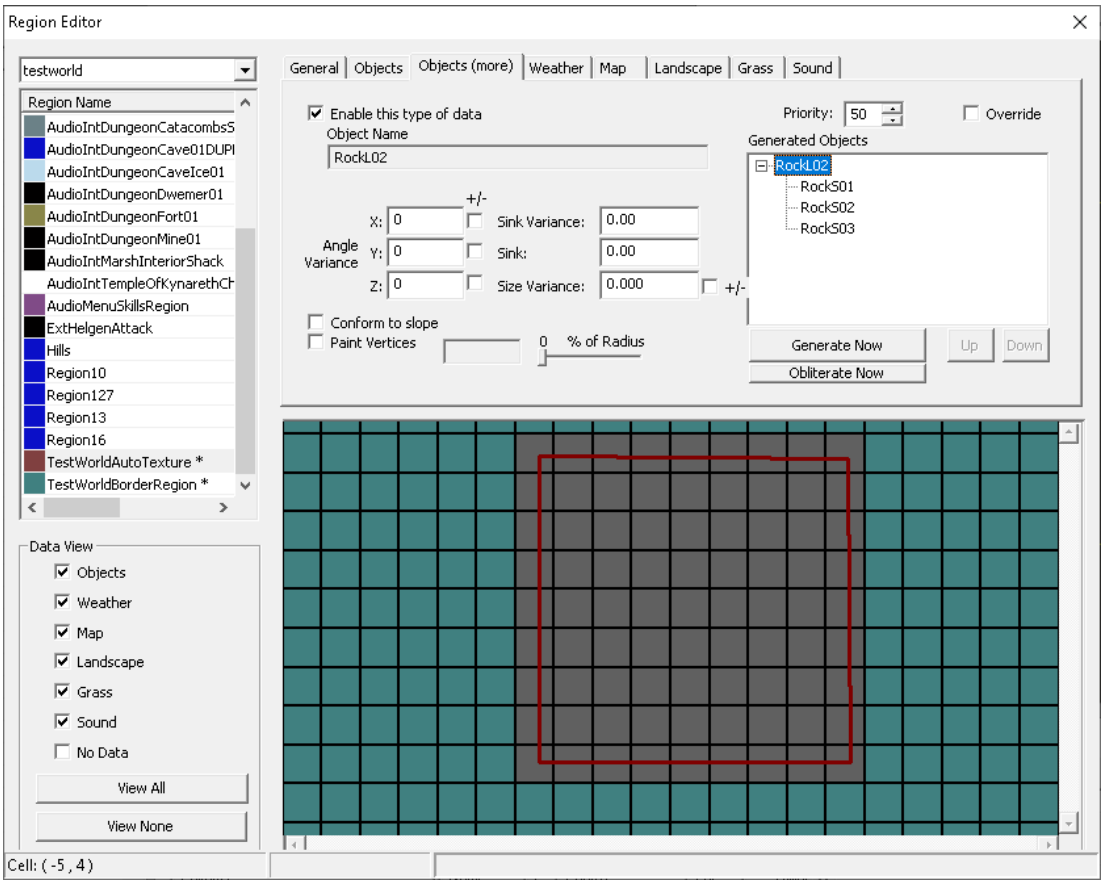

Figure 211 - Objects (more) tab.

To add some random rotation on the Z axis I set Z to 180.

I also set the Size Variance field to 0.400 allowing the scale of the object to randomize in a similar manner. Ticking the '+/-' button will allows negative values, i.e.: -0.4 to 0.4 instead of just 0 to 0.4.

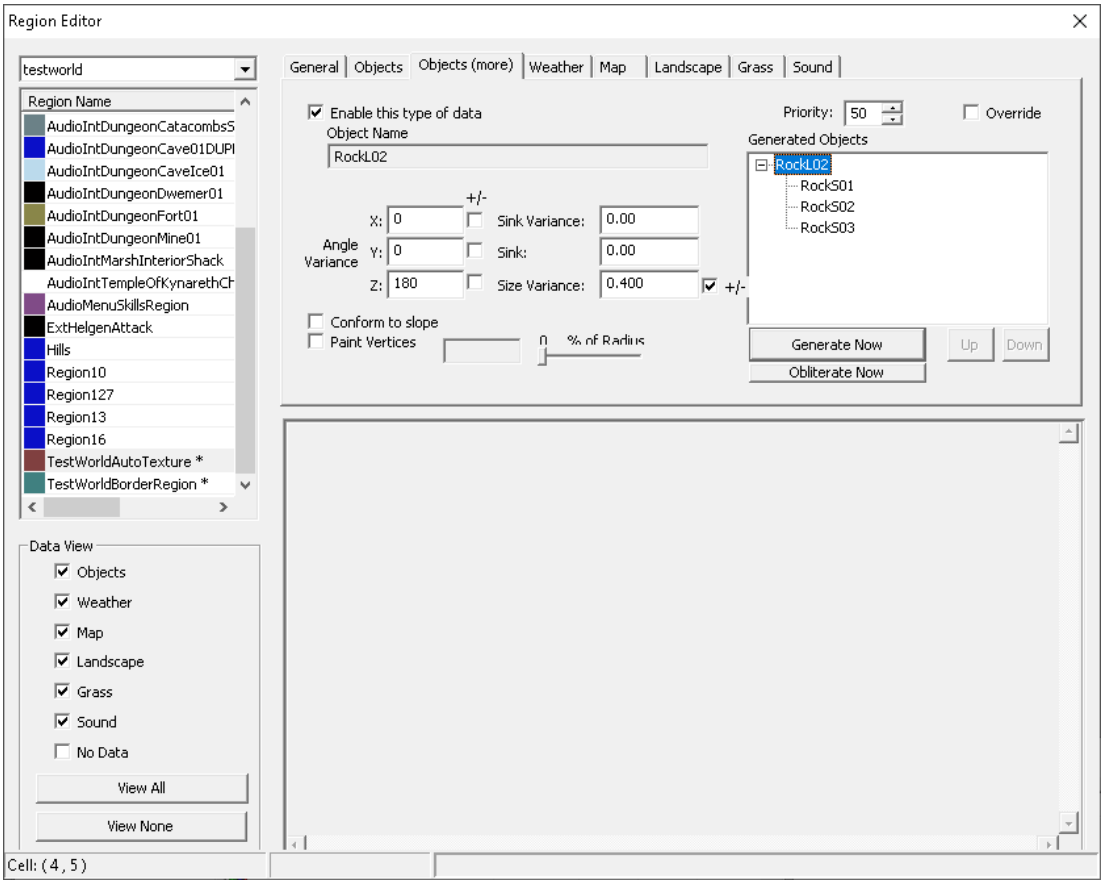

Figure 212 - Added Angle and Size variance.

After generating, we can see that each object is now facing a different direction and object scaling isn't as uniform as before.

Figure 213 - Objects with a little bit of variance.

Sink controls how far into the ground a generated object will be placed at, with Sink Variance adding some randomization to this amount.

Conform To Slope rotates the object in correlation to the slope it's placed on.

Let's try adding some trees next for more variety.

In this example I added TreeAspen01 and TreeAspen02.

I set the Min Height to -200000, increased their Density to 60 and reduced the Radius to 128. I also ticked 'Is a Tree' on both of them.

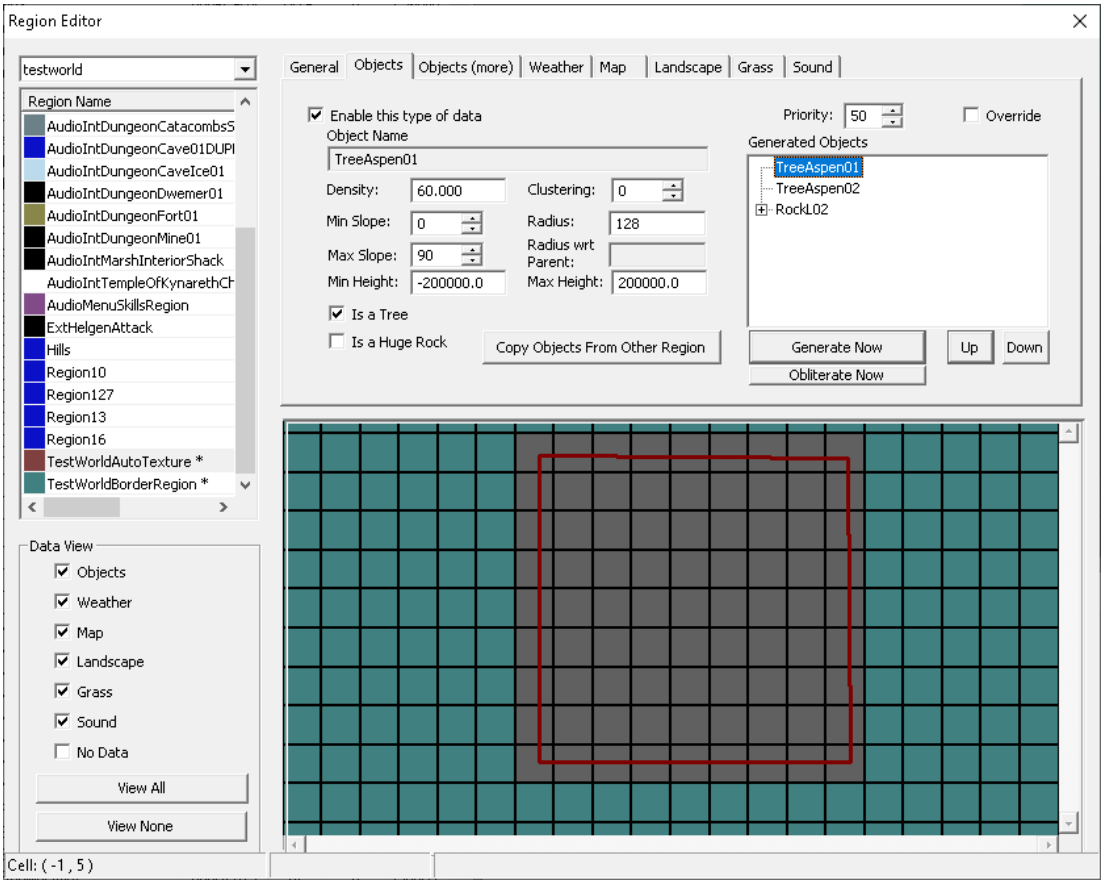

Figure 214 - Added aspen trees to Generated Objects list.

After generating here's what we have:

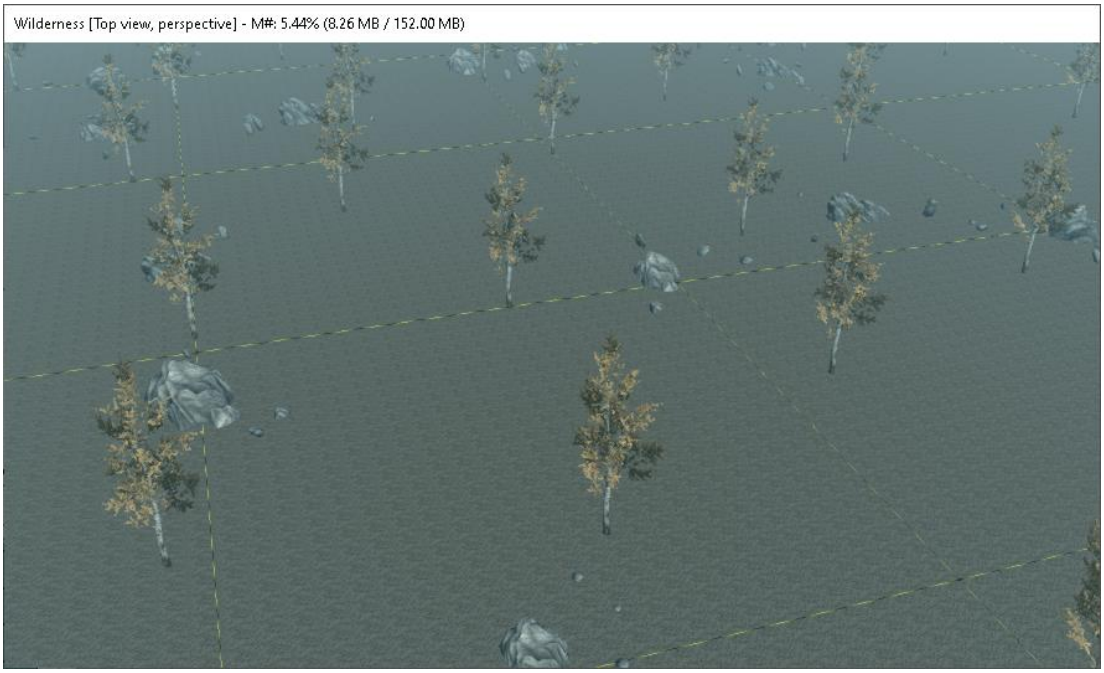

Figure 215 - Aspen trees generated on landscape.

The landscape looks a bit bare beneath them so let's add some thickets next.

From the Object Window I nested TreeThicket01 beneath each tree.

I set Min Height to -200000, Density to 60 and Radius wrt Parent to 1024.

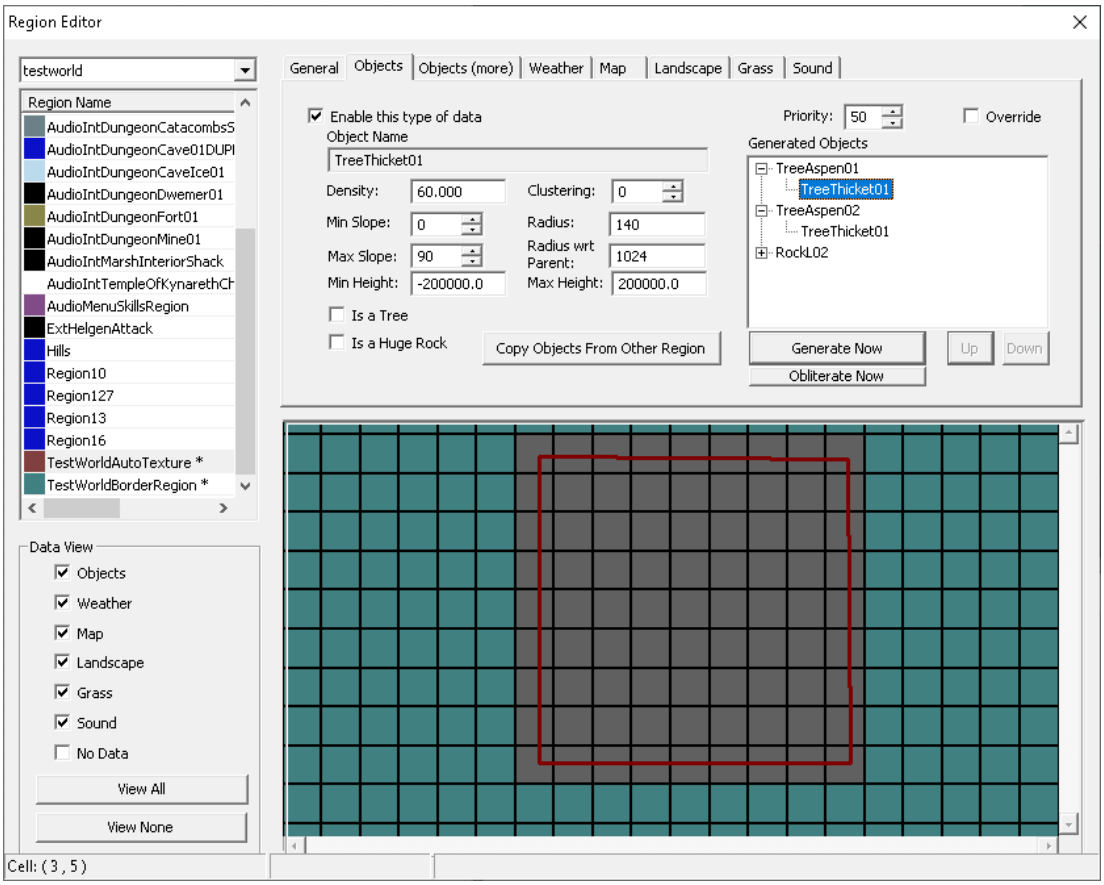

Figure 216 - Adding thickets.

You should now see thickets appear around the trees.

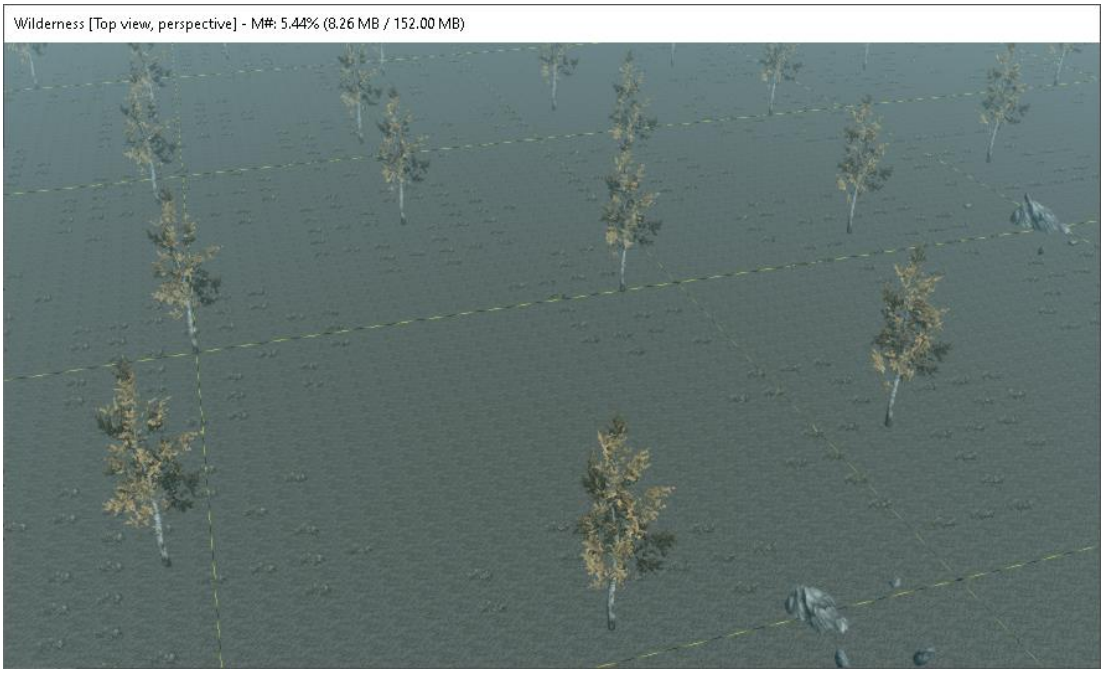

Figure 217 - Thickets appearing around the trees.

To fix the uniformity, let's try adding some variance next.

Set the Angle Variance for Z to 180, and the Size Variance to 0.200 then generate again.

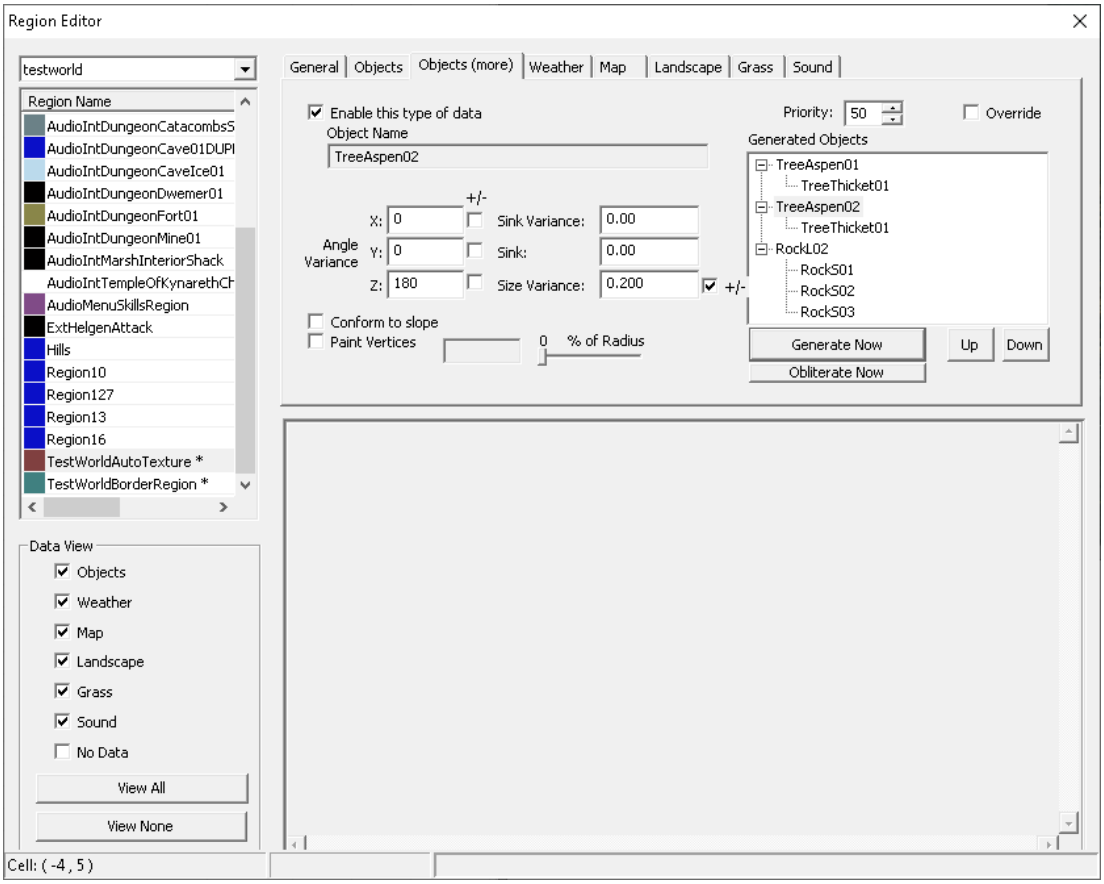

Figure 218 - Adding variance to the aspen trees and their thickets.

Interestingly, while the scale variance affected the aspen trees and the thickets, it does not appear that the angle variance had any effect. The angle variance is, however, still affecting RockL02 and the RockS01, RockS02 and RockS03 child objects.

Note: This might be a bug? If anyone can let me know, I would appreciate it.

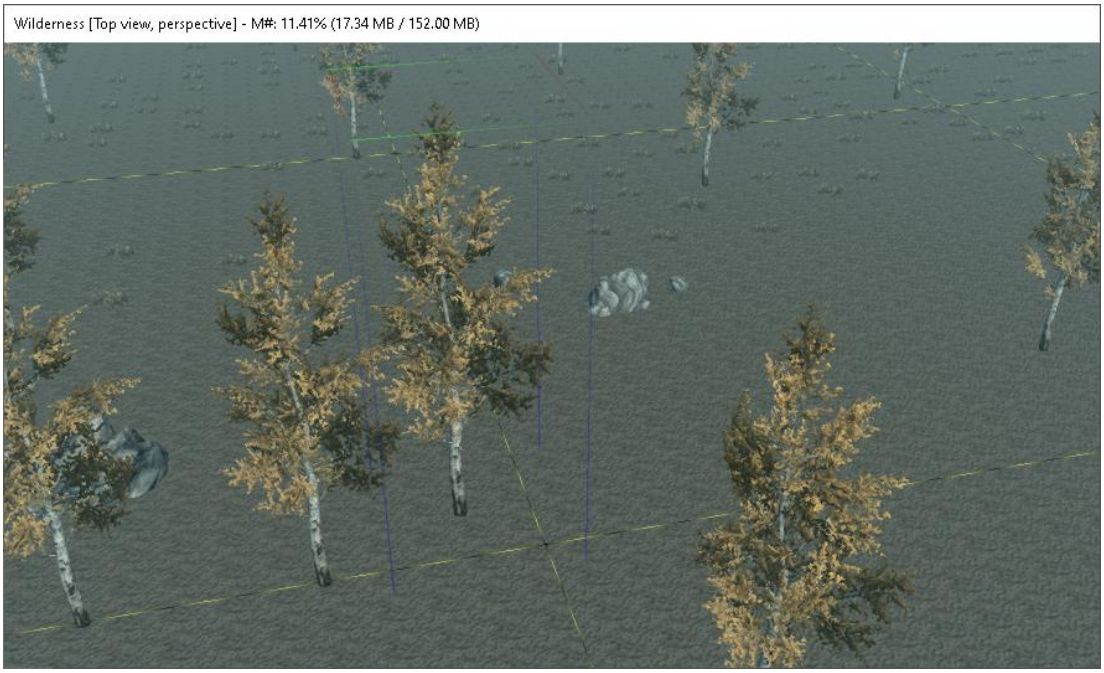

Figure 219 - Scale variance works on trees, but angle variance doesn't for some reason.

It also seems like Obliterate Now sometimes doesn't fully obliterate all parent trees...

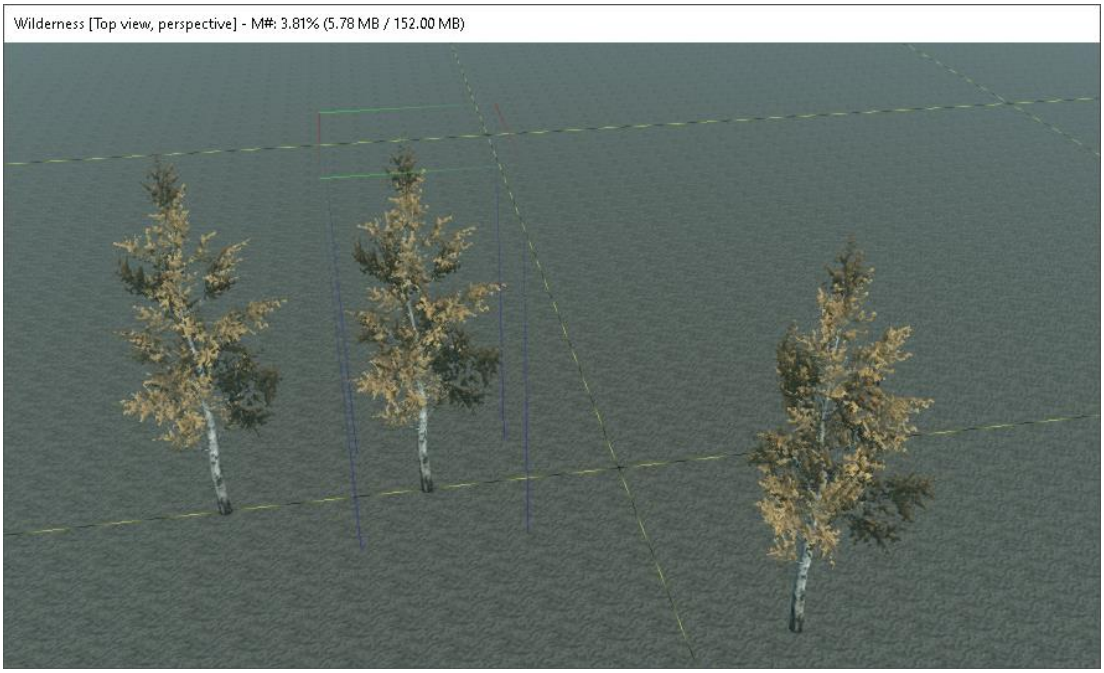

Figure 220 - Aspen trees not being fully obliterated.

Lastly, let's have a look at nesting textures below objects.

Nesting a texture below an object will cause that specific texture to be painted around instances of the parent object upon generation.

Important: Don't nest objects under textures.

To test this out I'm going to set the landscape texture LFallForestLeaves01 as a child of both aspen trees. I'm also going to paint LRocks01NoRocks beneath every instance of RockL02 by nesting it below RockL02.

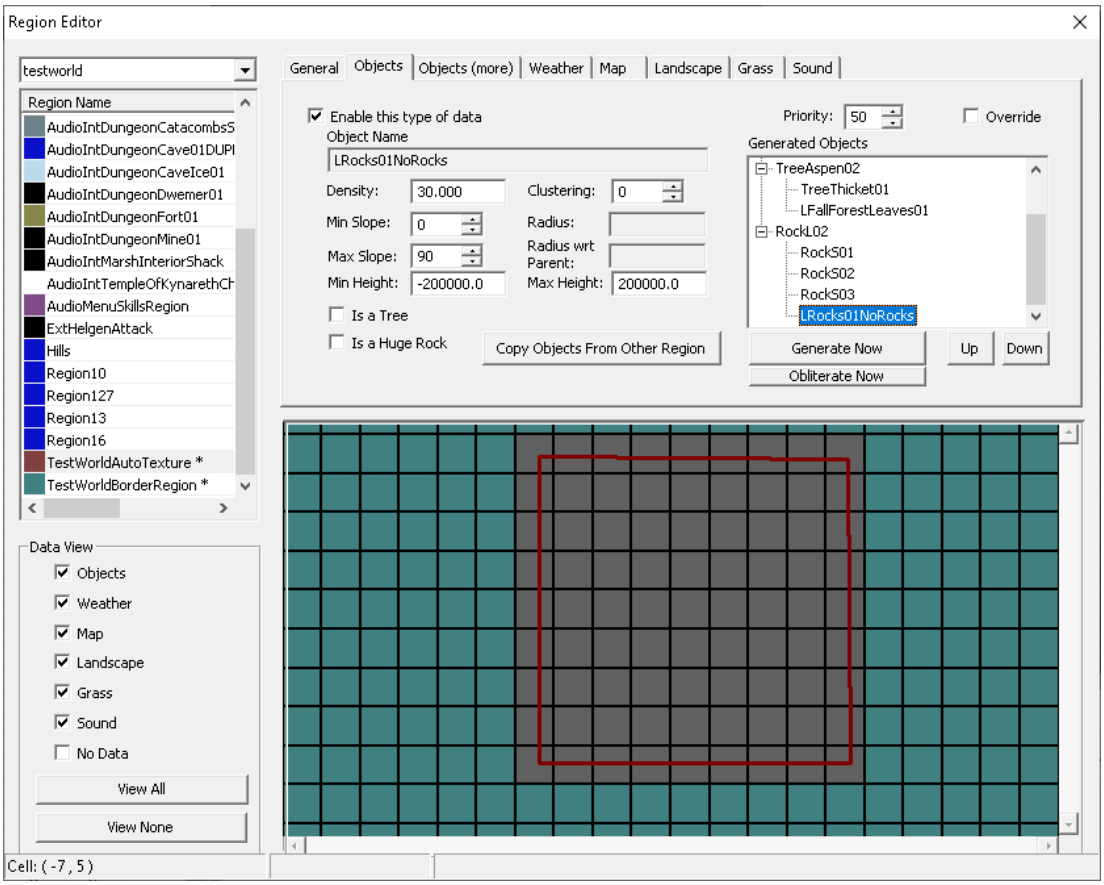

Figure 221 - Nesting landscape textures as children of parent objects.

After generating, our landscape looks like this:

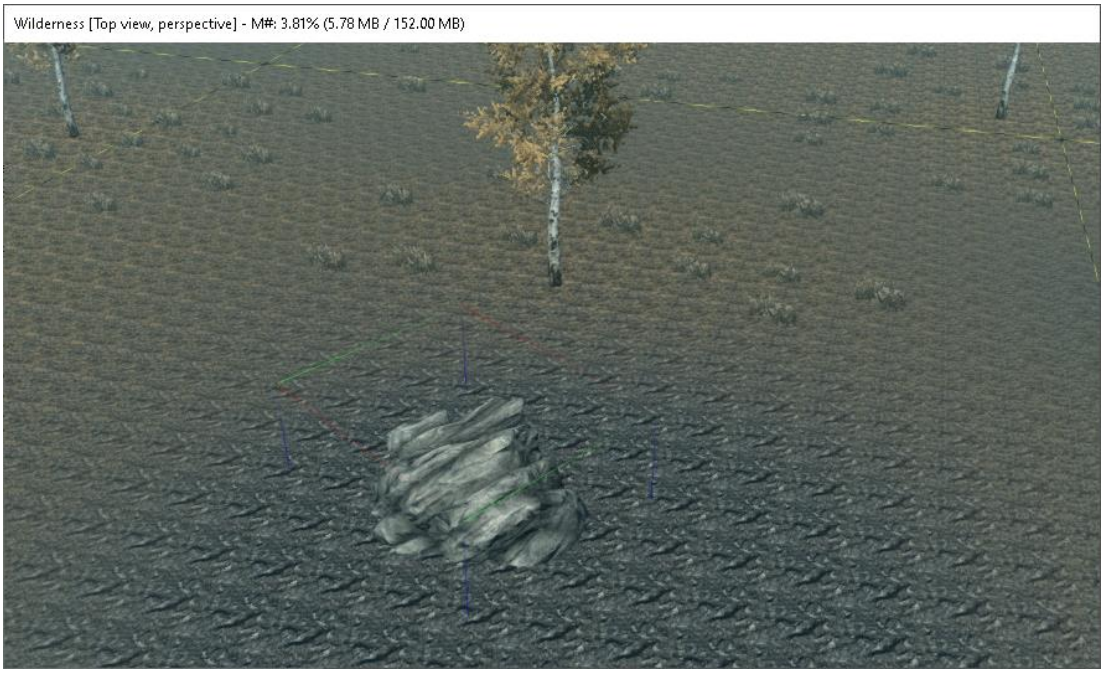

Figure 222 - Nested landscape texture.

We can control the size of the texture radius by adjusting the '% of Radius' slider.

By default the '% of Radius' slider is set to 0.

The percentage that the '% of Radius' slider is comparing against is the radius of the parent object. The closer to 100%, the smaller the radius of the texture.

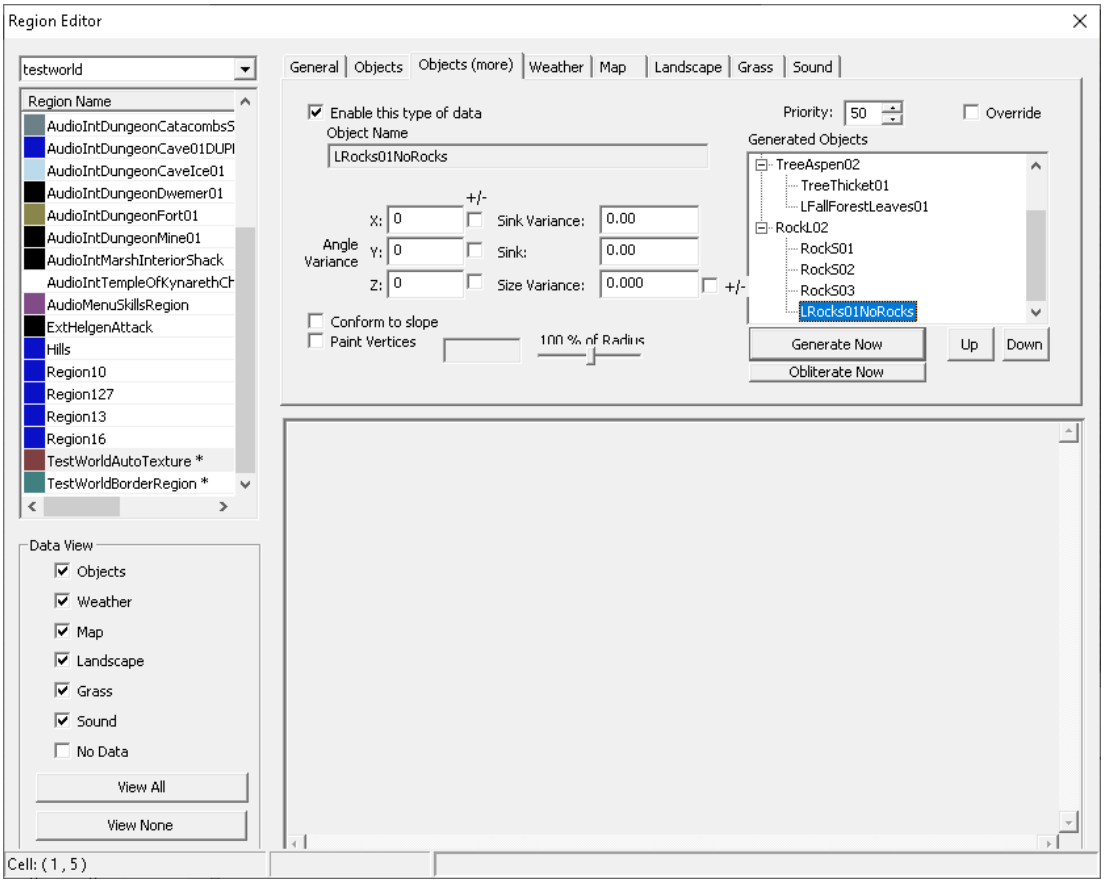

Figure 223 - % of Radius.

After setting the '% of Radius' slider to 100% for LFallForestLeaves01 and LRocks01NoRocks the textures beneath the parent objects no longer extend as far out.

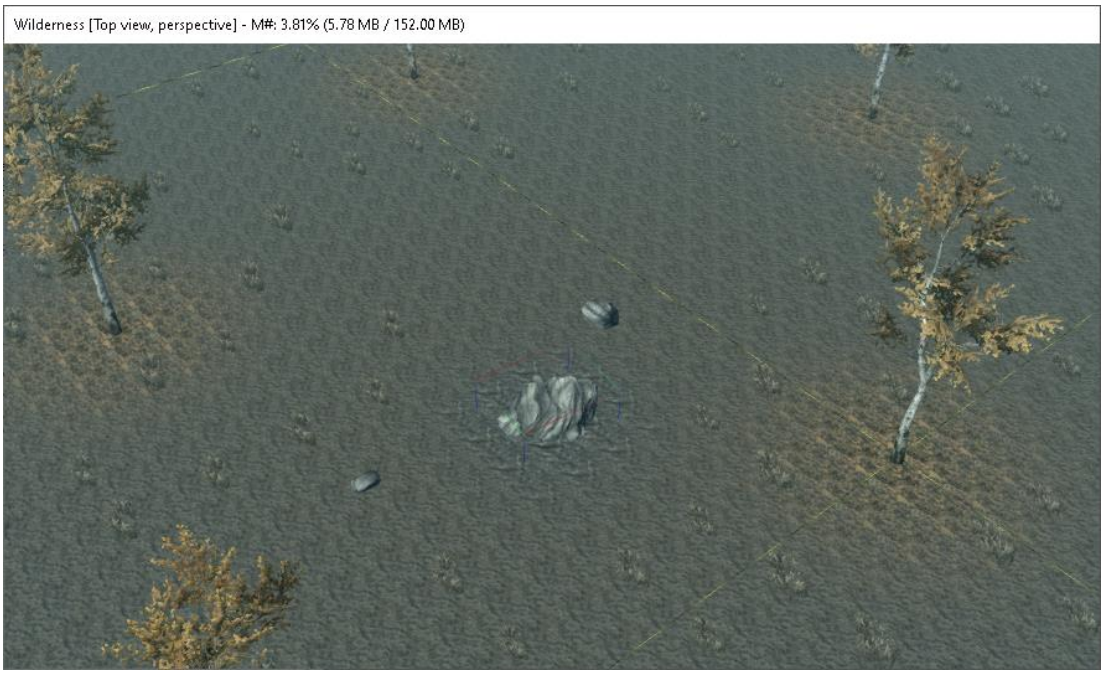

Figure 224 - Smaller texture radius around parent objects.

Increasing this value above 100% will again increase the radius of the texture around the parent object.

Important: You can combine this technique of nesting textures below parent objects with landscape texture generation discussed at the start of this section, just make sure you stick to 6 different types of textures or less otherwise you're going to end up painting vertex colours.

As far as I can see, none of the base game regions of the Skyrim world space have any textures or objects set up to auto populate, though they might've removed them from the Region Editor after generation.

For more information on what each field does, refer to the Regions article on the Creation Kit wiki.

SETTING UP LOCATIONS

Locations are also used by the radiant quest system. They can be used to attach radiant markers and NPCs with radiant flags to a specific location.

Generally speaking, for each settlement, bandit camp, animal den, dungeon, etc. that we create, we'll need to create a location record for it and assign it to the interior and/or exterior cells relevant to that location.

In the Object Window, go to WorldData > Location.

To create a new location, right-click on one of the existing locations and select New.

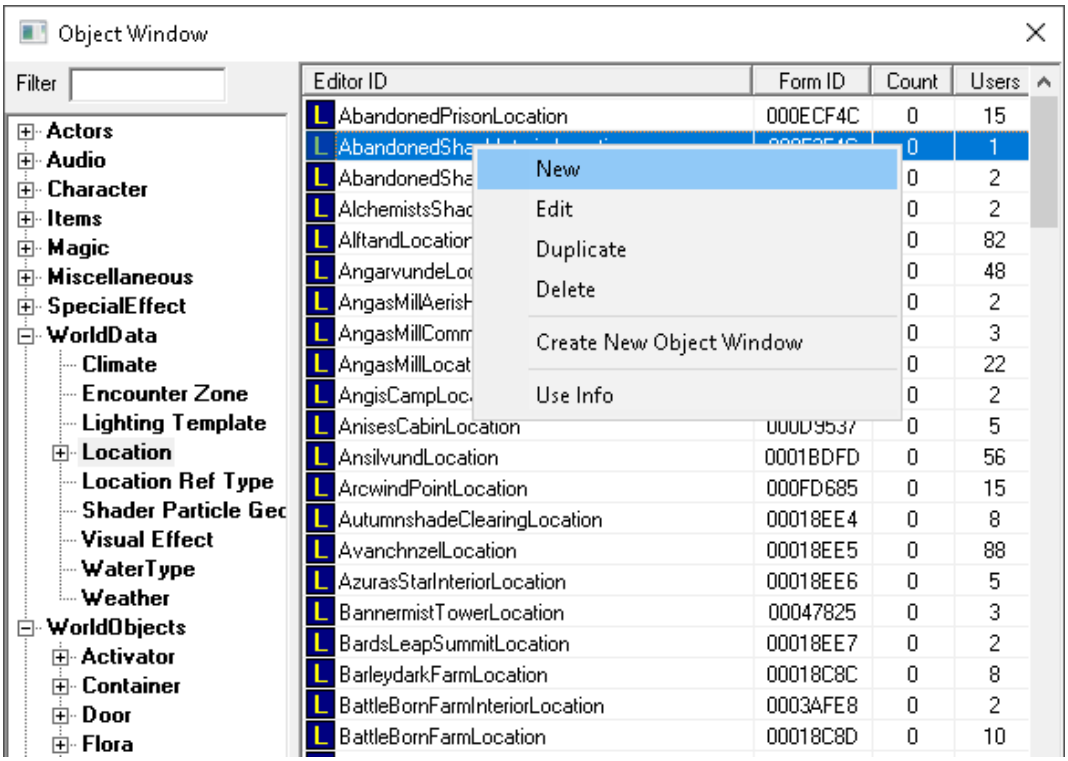

Figure 225 - Creating a new location.

Enter in the location ID. For my example, I'm going to use this location for a town named Stonehollow, so I'll set the ID to StonehollowLocation with the 'WT' prefix.

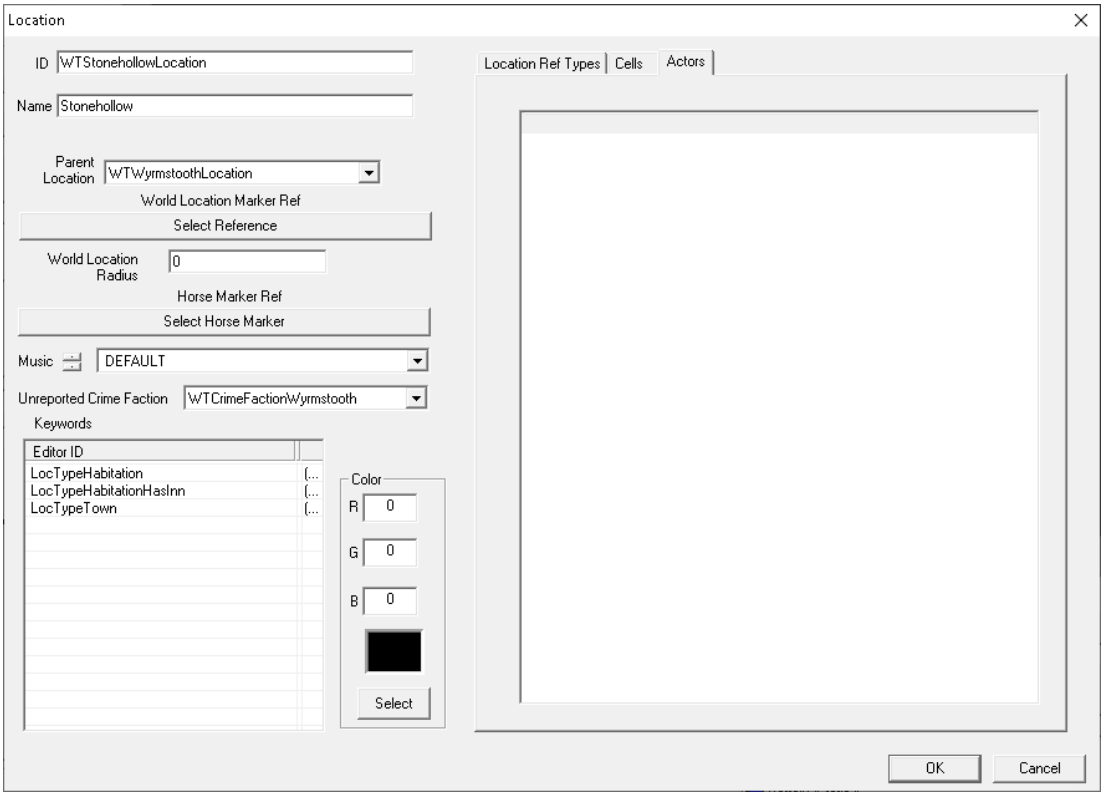

Figure 226 - Location properties.

I set the Name field to Stonehollow and the Unreported Crime Faction to WTCrimeFactionWyrmstooth which is the crime faction I use for the Imperial controlled locations on Wyrmstooth. For enemy-controlled dungeons you generally won't need to set an unreported crime faction.

Keywords are used by radiant quests and random encounters and are used to describe that location.

To add a keyword, right click in the keywords list and select Add.

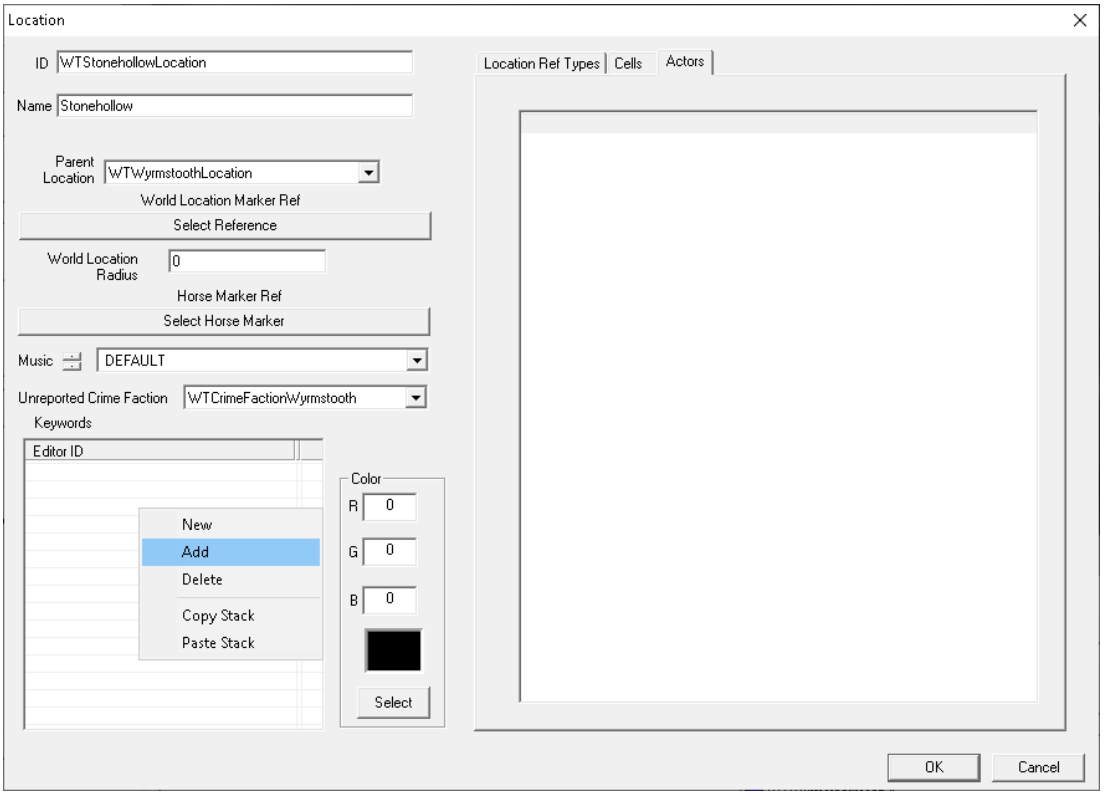

Figure 227 - Adding keywords.

Select the keyword and click OK to add it to the keywords list. Most keywords you'll want to assign are prefixed by 'LocType' so filter your search by that.

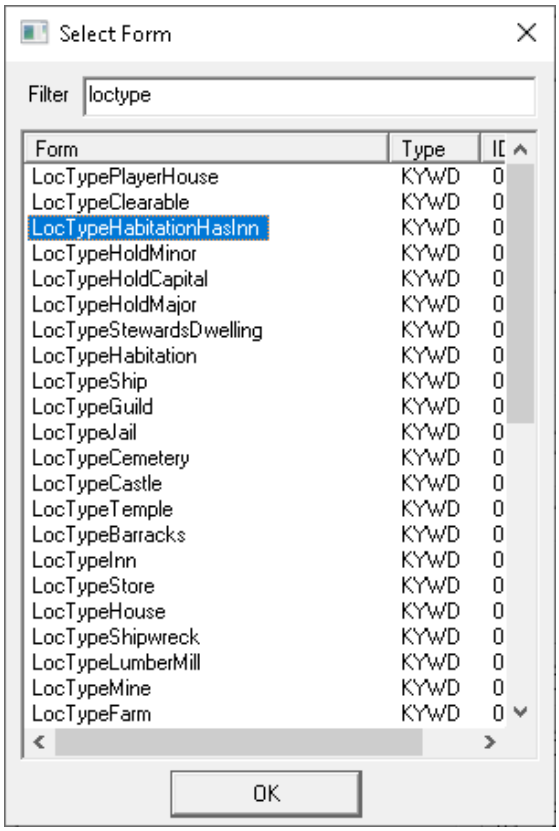

Figure 228 - Keywords list.

For my example, I added LocTypeHabitation, LocTypeHabitationHasInn and LocTypeTown. These keywords are used by most small settlements in the base game such as Riverwood.

I would recommend taking a look at the keywords added to locations similar to the one you're setting up to see what kind of keywords you may need to assign if you want the radiant quest system to use your new location.

Important: If you want your location to be clearable, add the LocTypeClearable keyword. Without this keyword, your location won't be flagged as 'cleared' on the map screen even if every boss NPC associated with that location has been defeated.

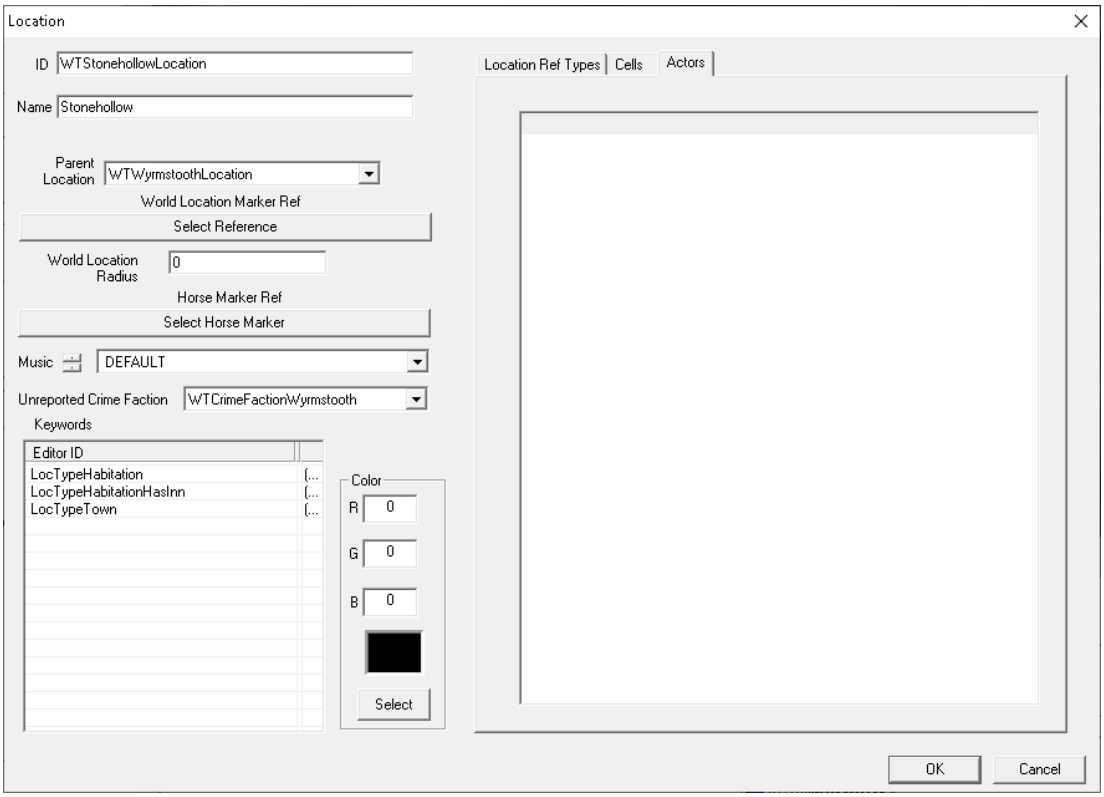

Figure 229 - Keywords added to location.

Click OK to exit out of the location properties.

Now to assign our new location to a cell.

Firstly, if you haven't already, you can rename a Wilderness cell by left-clicking on a cell you've highlighted or by pressing 'F2'.

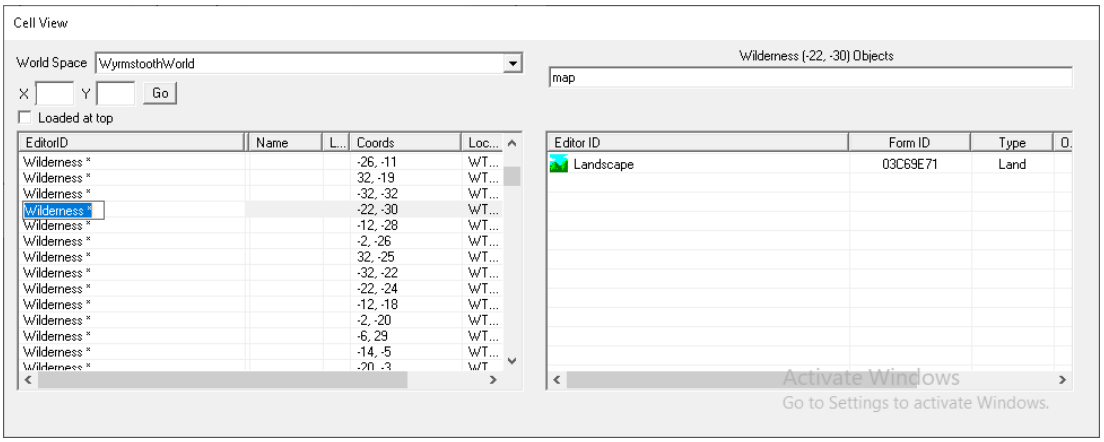

Figure 230 - Renaming a wilderness cell.

In the Cell View window, right-click on a cell you want to assign to the new location and select Edit.

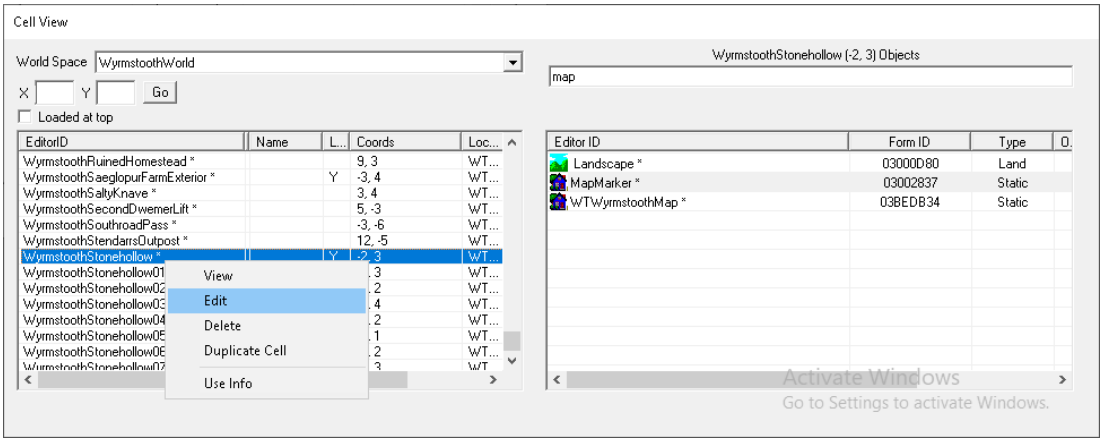

Figure 231 - Editing a cell.

You can specify a location in the Location drop-down.

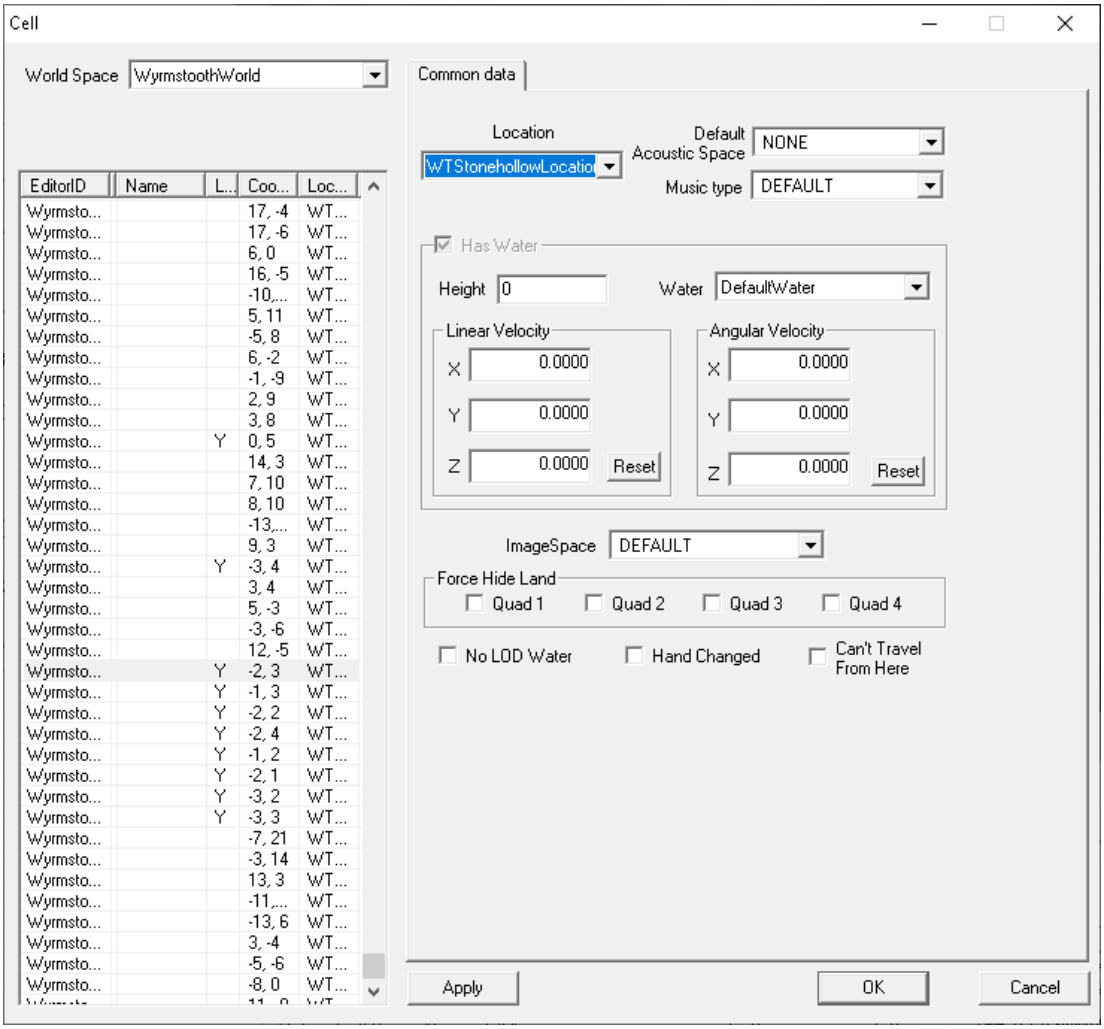

Figure 232 - Location assigned to cell.

If your location spans multiple cells, assign your location to those cells as well. You can assign a location to multiple cells including exterior world space cells and interior cells.

Click OK to close out of the Cell properties.

Locations can be nested by setting the Parent Location.

For example, Hulgard and Svenja's house is part of the Stonehollow settlement, so the Parent Location drop-down is set to WTStonehollowLocation. Internally, WTHulgardSvenjaHouseLocation will be treated as part of WTStonehollowLocation.

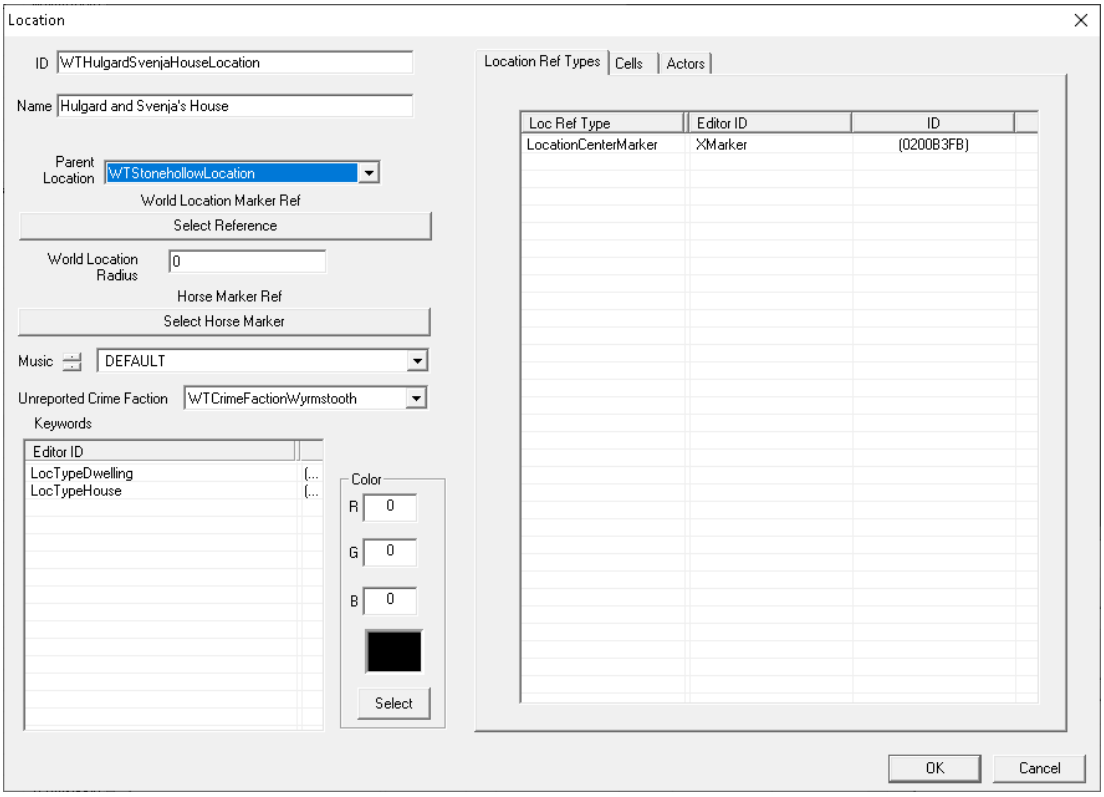

Figure 233 - Hulgard and Svenja's House location.

If you go back to the Location properties for the location you just created, you should now see a list of assigned cells in the Cells tab and a list of any NPCs in those cells in the Actors tab.

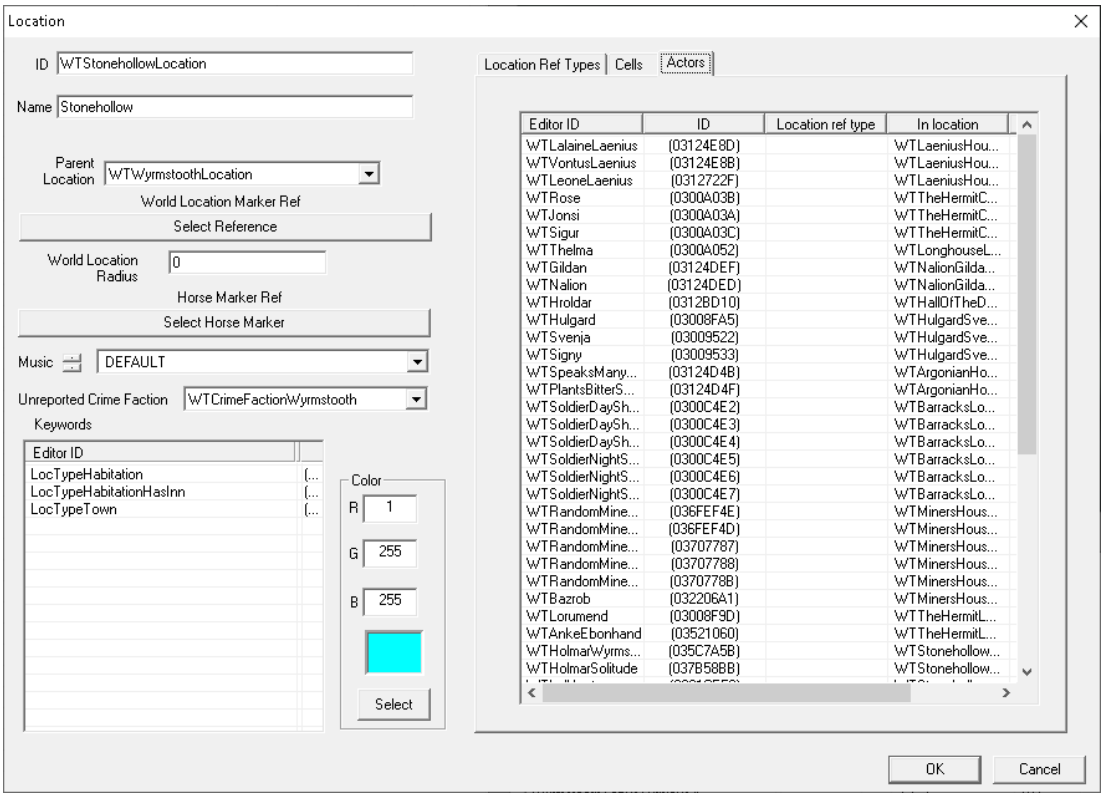

Figure 234 - Tabs are now populated with data from assigned cells.

SETTING UP ENCOUNTER ZONES

Encounter Zones are generally used to define the minimum and maximum levels of levelled list-generated enemies at a specific location. They can also be used to set a location to never respawn and to automatically set NPC or faction ownership of all items and containers in cells assigned to the location specified.

I created encounter zones for each clearable location on Wyrmstooth, such as dungeons, caves, or enemy controlled camps.

To create a new Encounter Zone, in the Object Window go to WorldData > Encounter Zone.

Right-click on one of the existing encounter zones and select New.

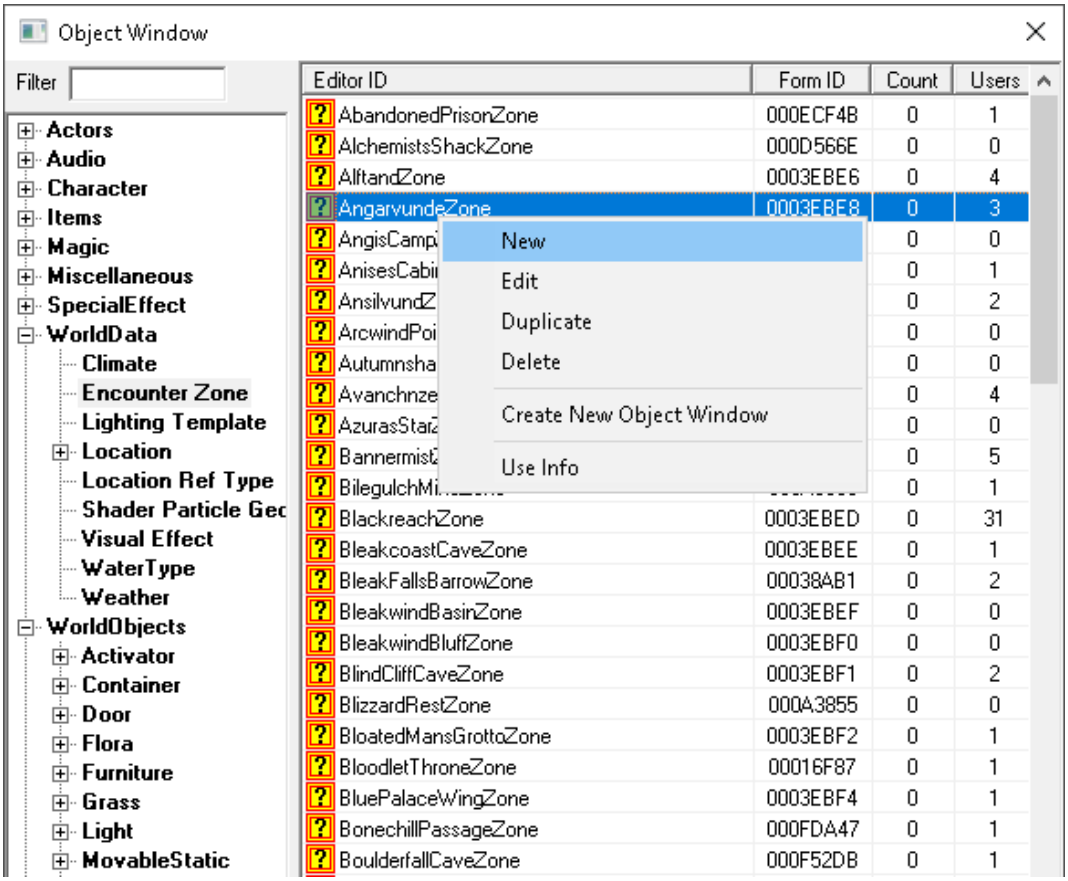

Figure 235 - Creating a new encounter zone.

Set the encounter zone ID. For my example I'll be creating an encounter zone for a cave called Coldwave Crescent.

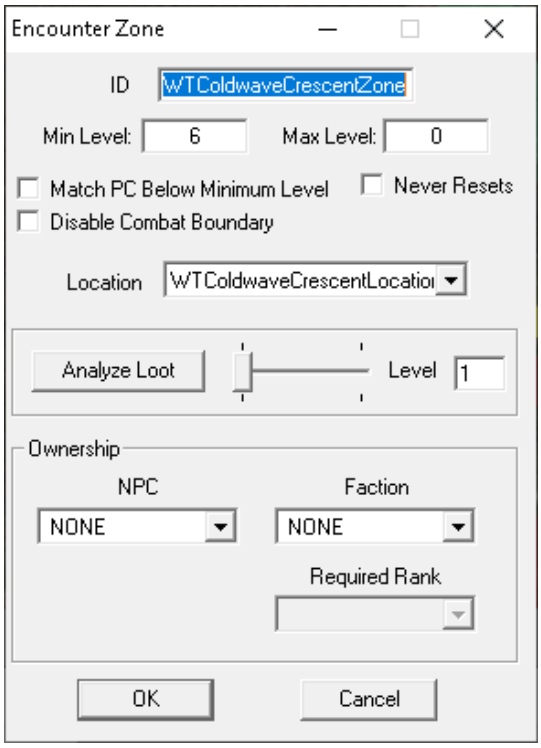

Figure 236 - Encounter zone settings.

I set the Minimum Level to 6. This will affect enemies spawned in using a levelled list.

If you wanted to increase the difficulty of the enemies spawned in a dungeon, you could increase the Min Level. Alternatively, if you want to prevent a dungeon from becoming too difficult, set a Max Level. Bleak Falls Barrow for example has a Max Level of 20. Draugr deathlords start spawning in at around player level 30 meaning you should never see a deathlord spawn in Bleak Falls Barrow due to this Max Level cap.

Set the Location drop down to the location you want to use this encounter zone for.

If you wanted to set ownership on all items and containers in the cells that use this encounter zone, you can specify that under the Ownership section. For my example, I'm going to keep these set to NONE as this cave will only contain hostile NPCs.

Ticking 'Never Resets' will prevent any cells that this encounter zone is assigned to from resetting. These kinds of encounter zones are assigned to player homes to prevent containers from resetting.

Diasble Combat Boundary allows hostile NPCs to leave this area to pursue the player if they are in combat with the player.

Match PC Below Minimum Level allows enemies spawned in using a levelled list to match the player's level if the player's level is below the Min Level specified.

Let's look at assigning this encounter zone to a cell next.

In the Cell View window, right-click on the cell you want to add the encounter zone to and select Edit.

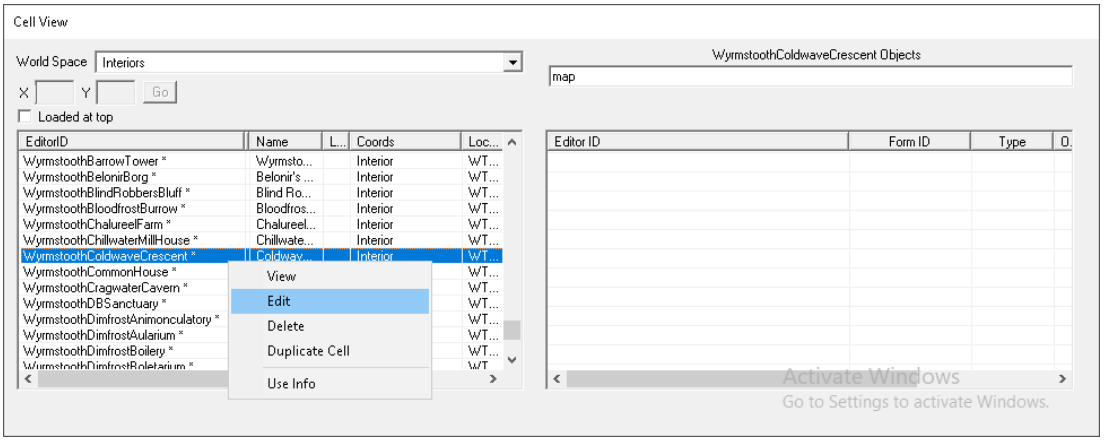

Figure 237 - Editing a cell.

Go to the Interior Data tab and set the Encounter Zone drop down to the encounter zone you created.

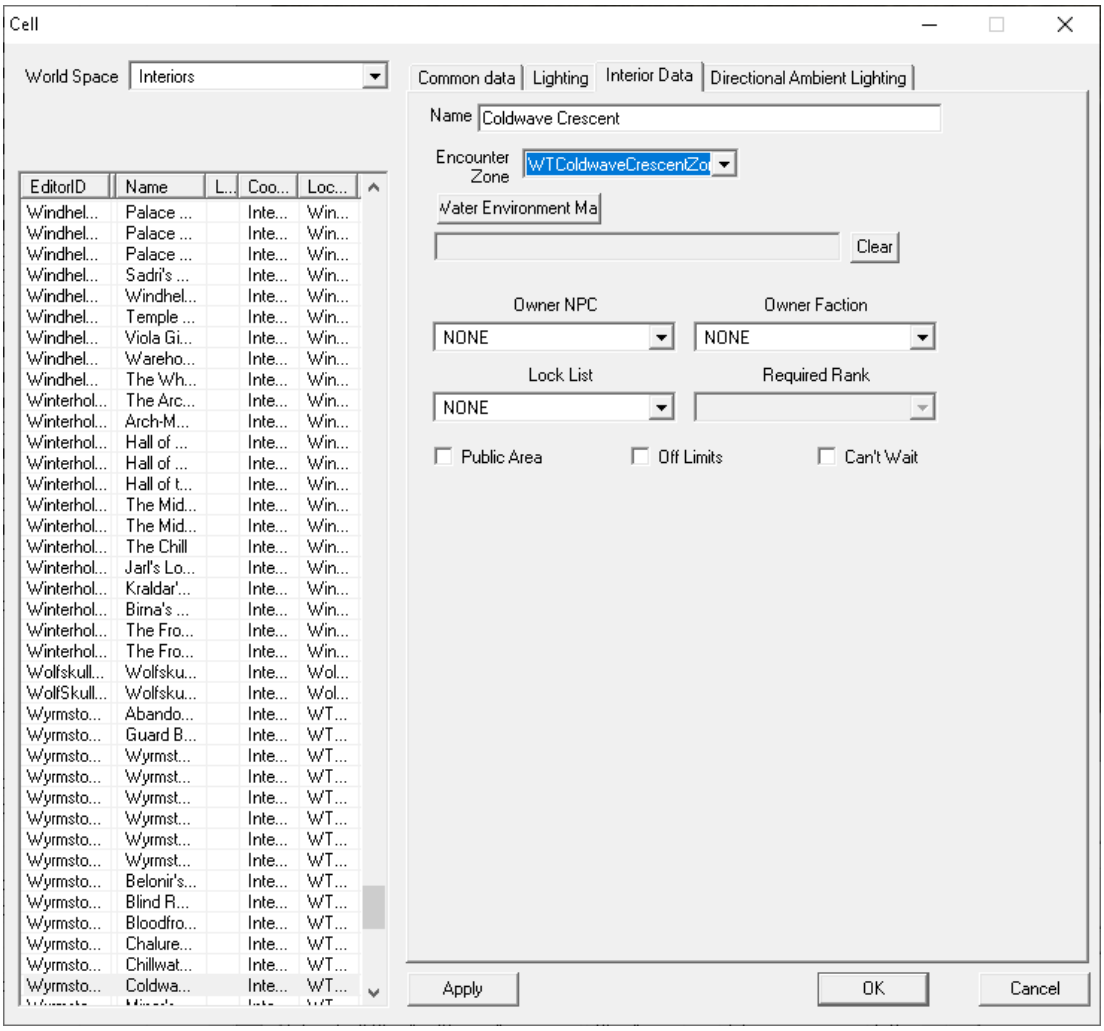

Figure 238 - Adding an encounter zone to a cell.

Click OK to close out of Cell properties.

For more information see the Encounter Zone article on the Creation Kit wiki.

ADDING NAVMESH

Navmesh is used to determine where NPCs can and cannot go. It also determines where NPCs can find cover during combat and allows NPCs to traverse between doors in interior cells and doors in exterior world space cells.

Simply put, any surface that an NPC should be able to walk on or swim over needs to be covered with navmesh.

Once navmesh has been added to a cell, it needs to be finalized before NPCs can use it. If you make any changes to any parts of the navmesh after finalization, you will need to finalize it again.

Navmesh is made out of vertices, edges and faces.

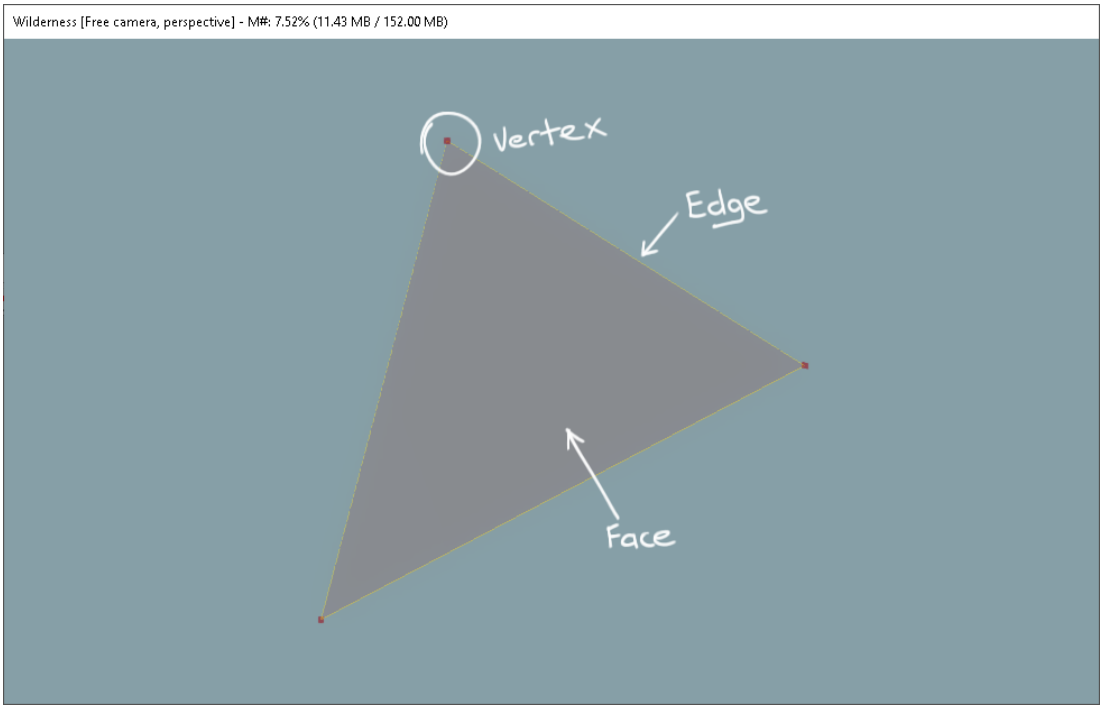

Figure 239 - Composition of a navmesh triangle.

To enter navmesh mode, click on the Navmesh button in the toolbar.

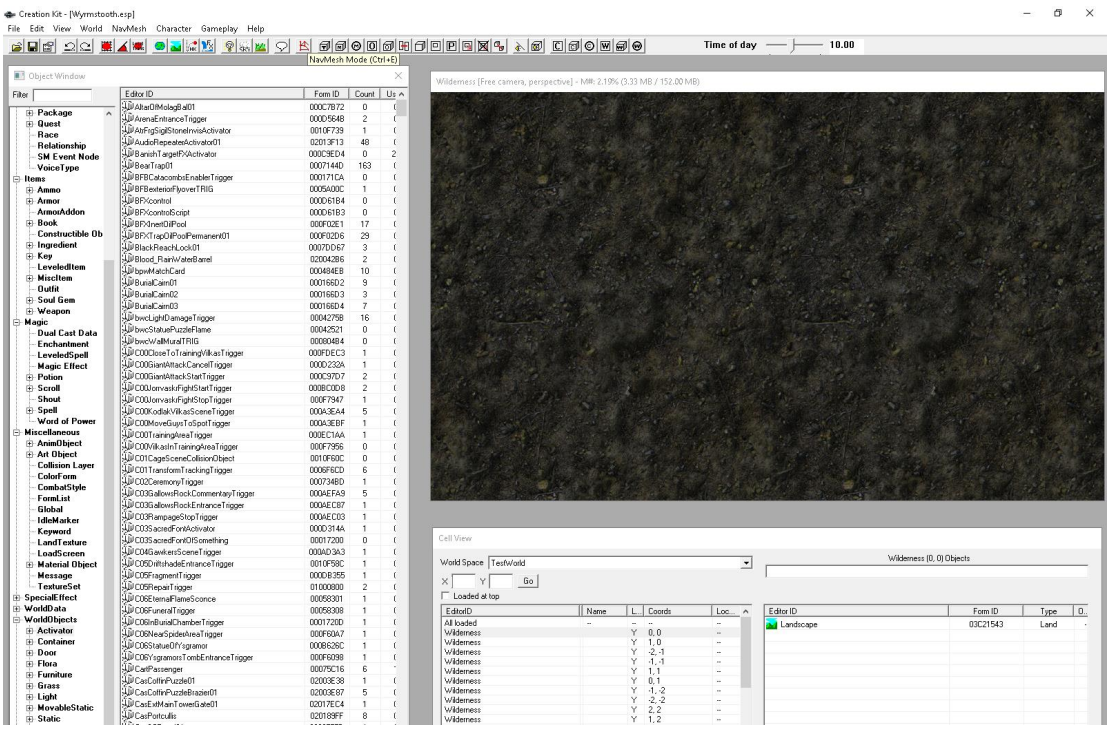

Figure 240 - Navmesh mode button.

When you enter navmesh mode, the navmesh toolbar will appear.

Figure 241 - Navmesh toolbar.

Navmesh is made of vertices that join together to form triangles. To begin manually creating navmesh, hold down CTRL and begin right-clicking in places where you want to place vertices.

Figure 242 - A navmesh triangle.

Once you've placed 3 vertices down they'll join together automatically while you're holding down CTRL.

You can move existing vertices, edges or faces around after placing them by left-click dragging the currently selected vertices, edges or faces.

Selected vertices, edges or faces are highlighted in green. To deselect, click on a surface that isn't covered by navmesh.

You can select multiple vertices, edges or faces by holding down CTRL.

To change the draw mode, press W. You can toggle between non-transparent, semi-transparent, and navmesh-only views. Non-transparent mode won't show navmesh occluded by other objects, semi-transparent mode will allow you to see the navmesh through the level, and navmesh only mode will hide everything else except navmesh.

For a list of navmesh shortcut keys, refer to the Navmesh Cheat Sheet.

If you keep right-clicking with CTRL held down, more triangles will be created automatically as you continue adding vertices.

Figure 243 - Adding more triangles to navmesh.

You can join three separate vertices together to form a triangle by highlighting them all and pressing 'A'.

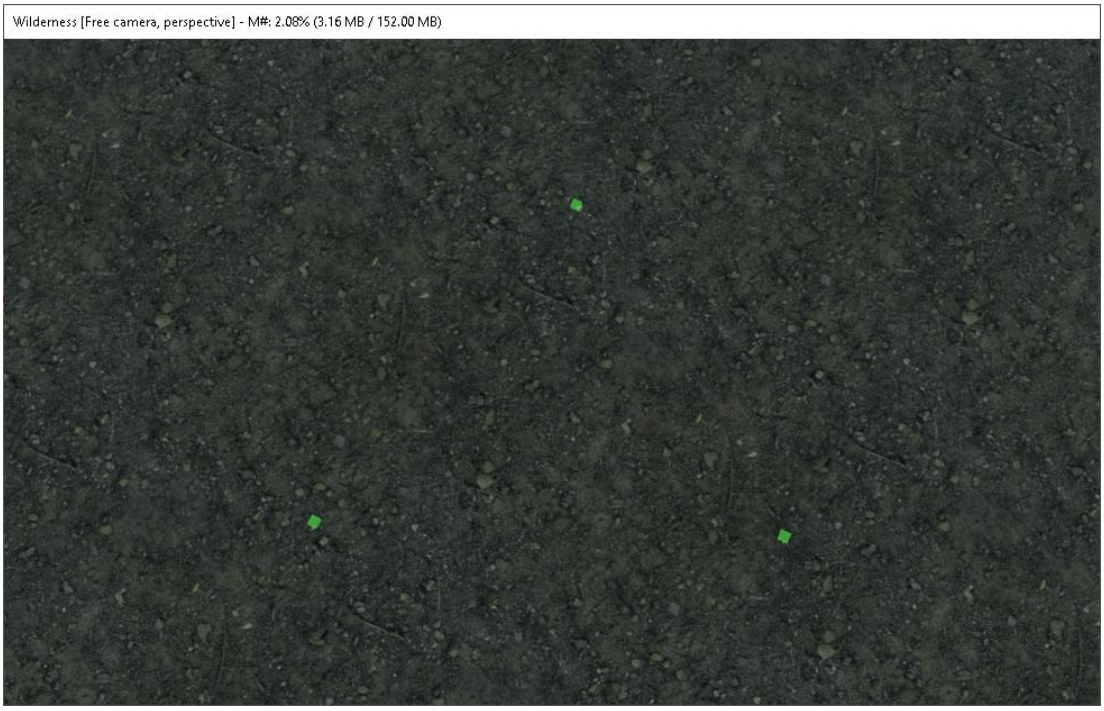

Figure 244 - Joining separate vertices.

You can also join four separate vertices together by selecting them and pressing 'A' to join them together.

Figure 245 - Joining four vertices.

Important: Don't overlap navmesh like this:

Figure 246 - An example of bad overlapping navmesh. Avoid doing this!

There's nothing wrong with having a navmeshed pathway like a bridge above navmeshed terrain, but navmesh that's closely overlapping as per the screenshot above will result in errors and should be avoided.

If you need to select an entire navmesh segment, click on one triangle and press 'F'. This will select all adjoining faces.

Figure 247 - A navmesh island selected.

Note: You can move navmesh around like an object by left-click dragging highlighted vertices, edges or faces, but in most cases you won't want to do that as navmesh will need to conform around objects and to your landscape.

To delete the currently selected vertices, edges or faces, press Delete.

Here's an example of what navmesh around an object should look like.

Figure 248 - Navmesh around a rock.

When finalizing navmesh, sometimes extra vertices may be added automatically, splitting up large triangles, but try and be mindful of the complexity of your navmesh topology as it will affect the overall size of your mod.

Important: Navmesh should conform to the surface that an NPC will be walking on.

Also, make sure vertices are not placed in the air! This can happen if you try and navmesh over fog volumes. To bring a vertex, edge or face to the ground, select it and press 'F' to make it fall to the nearest surface. You can also manually raise or lower a vertex, edge or face by holding down Z as you left-click drag it to constrain it to the Z axis.

When navmeshing a road, it's important to keep the vertices to either side of the pathway. Having the topology of the navmesh flow with the road should help prevent NPCs tracking off the road when traveling to a particular location.

Here's an example of what a navmeshed road should look like:

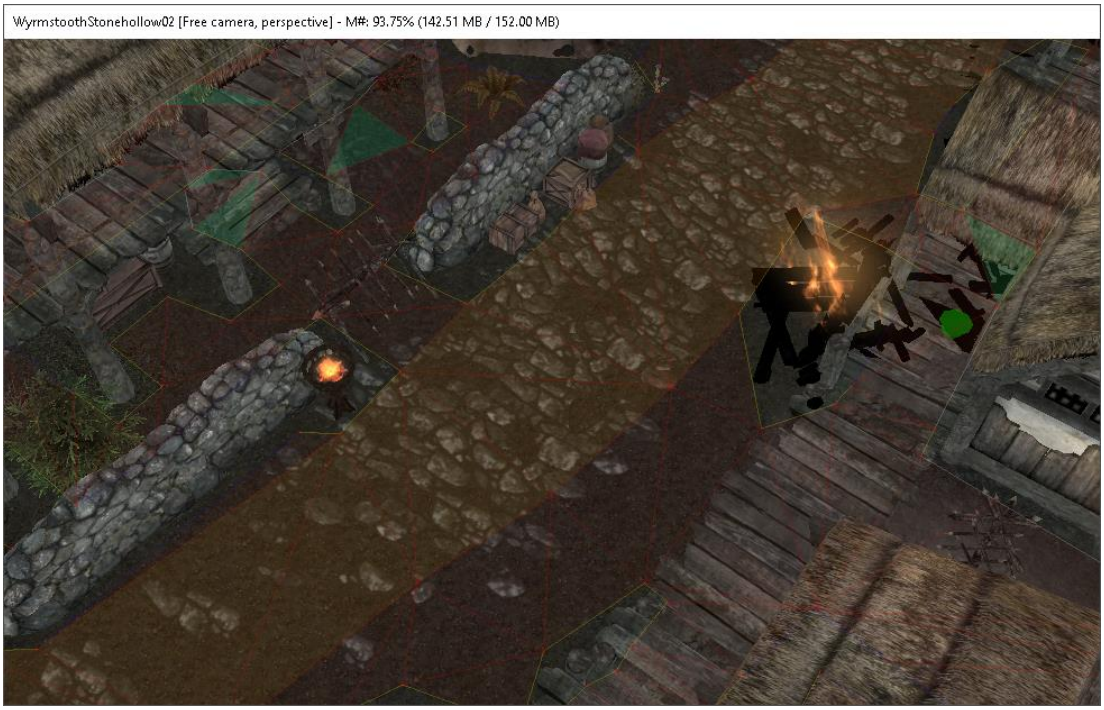

Figure 249 - An example of a navmeshed road.

The yellow navmesh over the road indicates a preferred pathway. You can turn a regular navmesh triangle into a preferred pathway triangle by selecting it and pressing 'P'. The colour of the triangle should turn from red to yellow.

NPCs traveling from one location to another will try and do so via the nearest preferred pathway if one exists.

To allow NPCs to travel from an interior cell into an exterior world space cell via door markers, you'll need to make sure a navmesh triangle is placed under each door marker. When you finalize the navmesh, the triangle under the door marker should turn green as per the screenshot below:

Figure 250 - A green navmesh triangle under a door marker.

Important: You'll need to have a green navmesh triangle under both door markers.

Navmesh can't across cell borders, nor can you join vertices together from different cells. To join the navmesh from two separate cells together you'll need to join navmesh vertices along both sides of the border before finalizing as per the screenshot below:

Figure 251 - Joining navmesh between world space cells.

Navmesh edges that have been successfully joined together along a cell border will be marked in bright green after you finalize.

Press 'B' to show cell borders in the render window.

Here's a closer look at the navmesh at the cell border:

Figure 252 - Border vertices pulled apart.

In the screenshot above I pulled apart the vertices along the border to demonstrate how the vertices of the navmesh vertices need to be closely overlapping.

Important: If the vertices are too far apart, the navmesh edge along the border won't turn bright green when you finalize and NPCs won't be able to cross that point from one cell to another.

Figure 253 - Border vertices joined back together again.

In the screenshot above, I moved the vertex back to where it was.

Navmesh beneath the ocean or a water plane should be marked as water triangles. To do so, select the faces beneath the water and press 'O' to turn them into water triangles.

Water triangles appear blue in the render window.

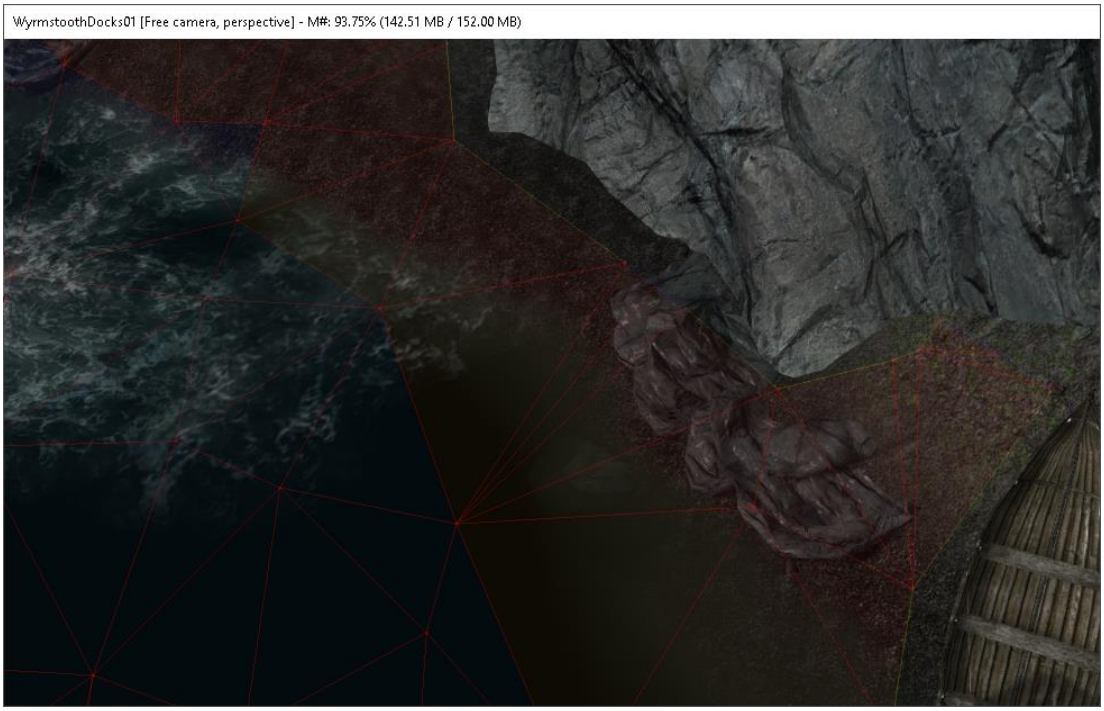

Figure 254 - Water triangles at a coastline.

Terrestrial NPCs should *try* to avoid pathing through water triangles when fleeing or pursuing an enemy.

Creatures that live in the water, such as slaughterfish, should also avoid crossing into non-water triangles.

Press the Find Cover Edges button in the navmesh toolbar to automatically mark navmesh edges that may provide NPCs with cover during combat.

Figure 255 - Navmesh cover.

Navmesh cover will be marked in blue. Edges near walls and fences are usually automatically flagged as cover edges.

Note: You can manually define which edges are cover edges. Click on the navmesh edge to select it then press 'E' to bring up Edge Cover properties.

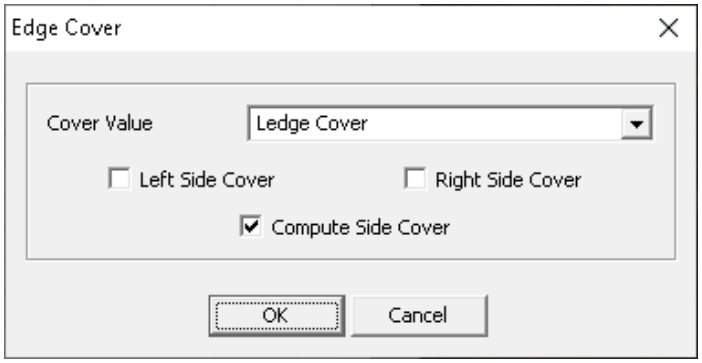

Figure 256 - Manually defining cover.

If you can't select a navmesh edge, press 'G' to toggle edge selection on or off.

Before finalizing, it's important to check for errors. You can do so by going to Navmesh > Select Triangle By Index. This will check the current cell for navmesh errors.

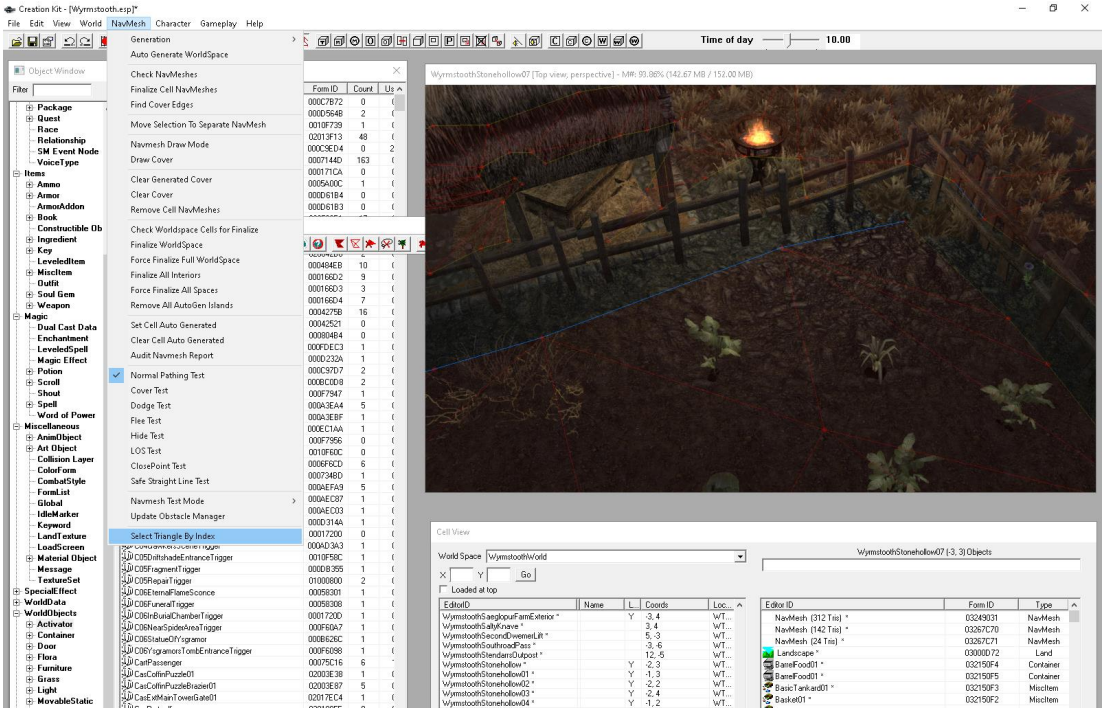

Figure 257 - Select Triangle By Index.

Click 'Check NavMesh' to check for navmesh errors.

Figure 258 - Select triangle.

If a navmesh error is found, the offending triangle will be highlighted automatically and shown in the render window.

You'll need to fix the error by hand, usually by deleting the bad triangle and recreating it. Sometimes you'll also need to remove some of the triangles around it too and rework the surrounding topology if the error persists.

Once the bad triangle has been fixed, click Next Warning and continue until no more warnings are found.

Figure 259 - No Warnings Found.

Once all navmesh errors have been corrected, you'll see 'No Warnings Found'.

When the Creation Kit loads a mod, any navmesh errors found will be listed in the EditorWarnings.txt file, so it's important to check that file after loading your mod in the Creation Kit whenever you're working on navmesh.

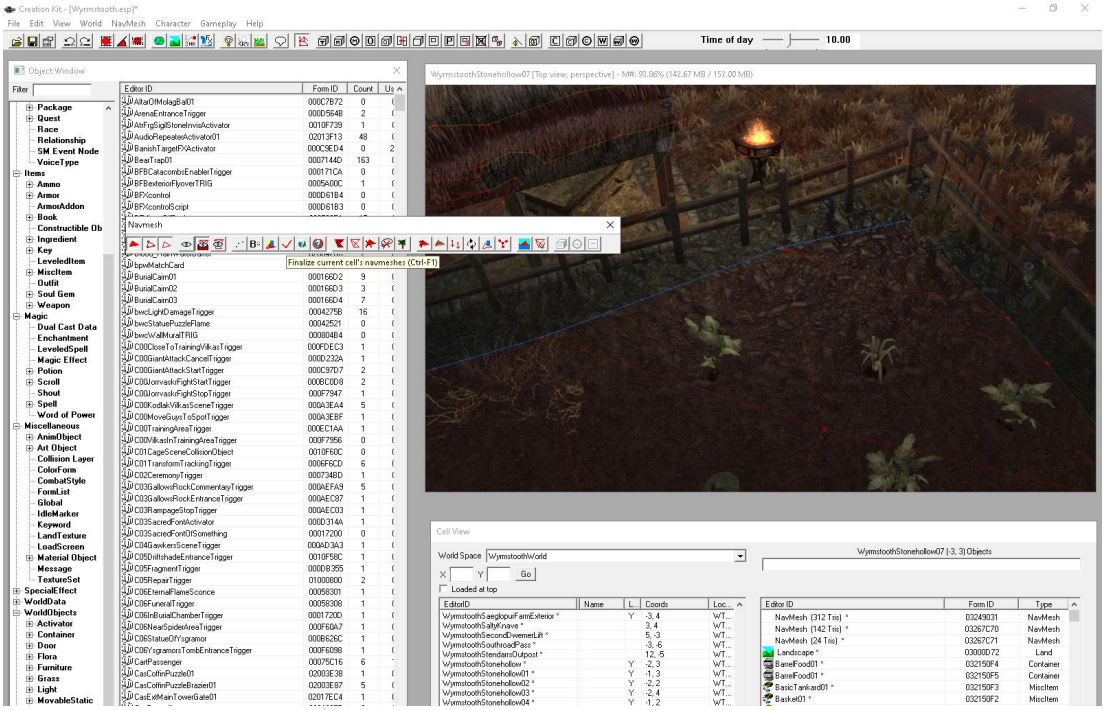

Figure 260 - Finalizing navmesh.

To finalize navmesh, click on the Finalize Cell button in the navmesh toolbar.

Important: There are several methods to automatically generate navmesh for a specific cell or even an entire world space, but to be honest I would actually recommend just navmeshing by hand despite how incredibly tedious that might sound.

Automatic navmesh generation tends to create a lot of 'navmesh islands' which are sections of navmesh that aren't joined to anything, and you'll need to spend time deleting them or joining them together so NPCs don't end up getting stuck if they happen to somehow enter one.

Automatic generation also tends to create a lot of inefficient sunburst vertices. A sunburst vertex is a single vertex that a bunch of navmesh edges connect to as per the screenshot below. You should delete these and retopologize your navmesh manually.

Figure 261 - An example of an inefficient sunburst vertex.

The topology of your navmesh in open areas of your world space should be a bit more evenly distributed like this instead:

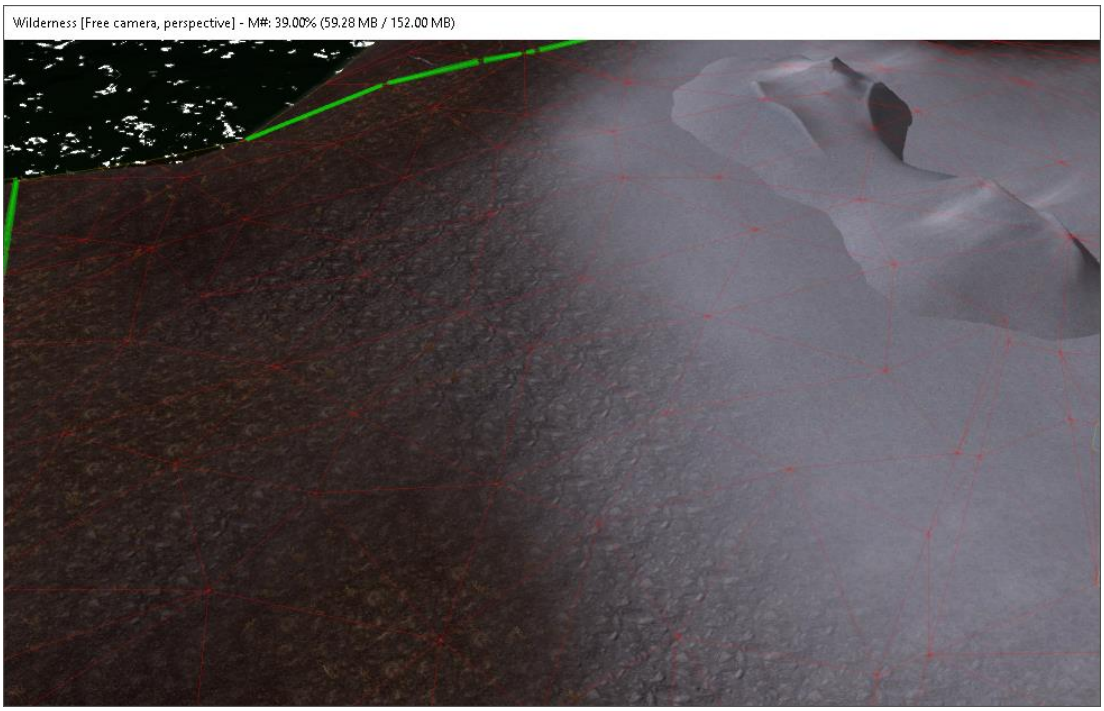

Figure 262 - An example of slightly better navmeshing.

While Auto Generate World Space does have a recast generation option, it lacks the same settings that Recast-Based-Generation has to control where exactly navmesh is automatically placed. The trade-off however is that you will need to run this manually in each cell of your world space that requires navmesh.

Note: If you really need to automatically generate navmesh, I'd recommend using Recast-Based-Generation on a cell-by-cell basis rather than Auto Generate World Space.

Go to NavMesh > Generation > Recast-Based-Generation.

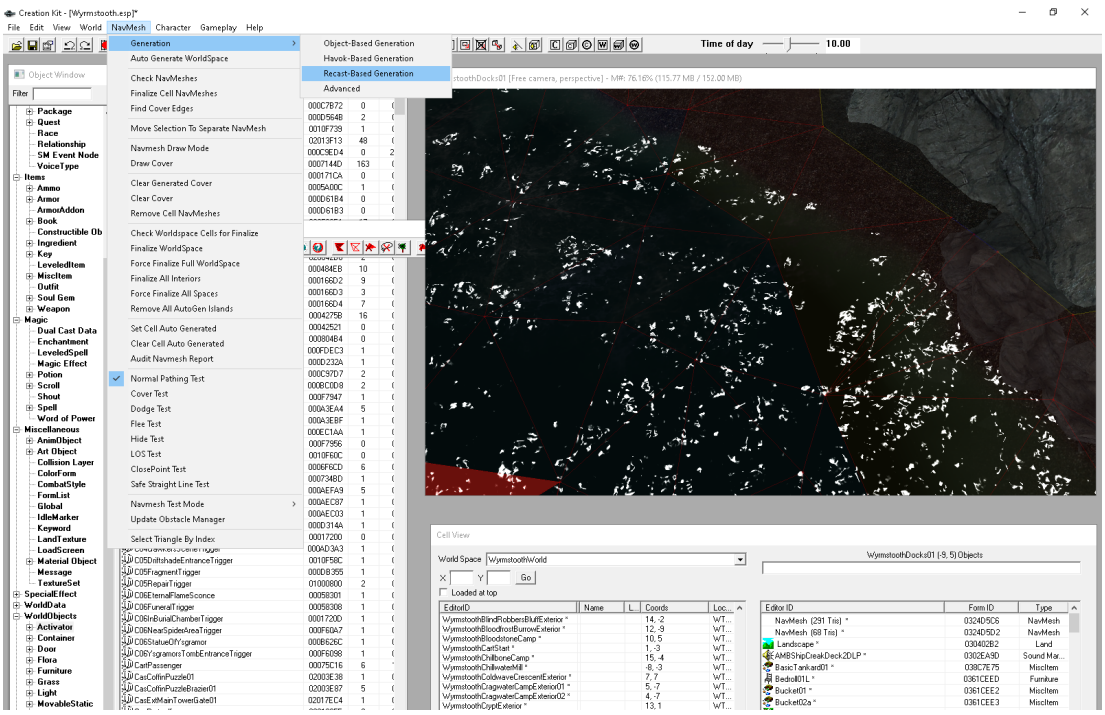

Figure 263 - Recast Based Navigation menu.

Keep the settings at their default, but change Agent Radius to 8.0000 before clicking OK. If too many small navmesh islands are created, try setting the Agent Radius back to 32.0000.

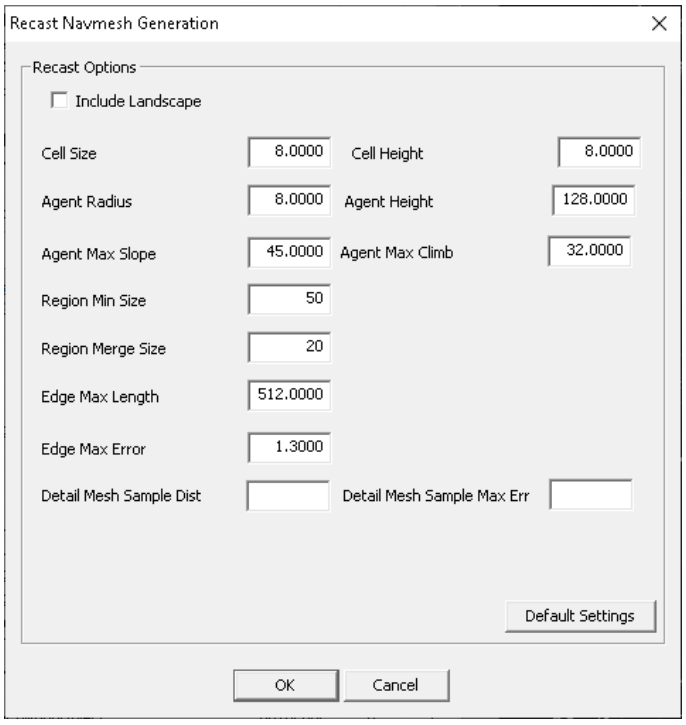

Figure 264 - Recast Navmesh Generation.

ADDING OCCLUSION GEOMETRY

Occlusion planes and occlusion cubes are used to improve performance by hiding objects. They are usually hidden within large structures such as buildings, castle walls, and sometimes within mountain ranges to cull objects that the player should not have direct line-of-sight to.

There are two types of occlusion geometry; occlusion planes and occlusion cubes. Occlusion planes are two-dimensional and can only be resized on an x/y axis. Occlusion cubes on the other hand are three dimensional.

In the following screenshot, the rock will be occluded based on the player's current position and won't be rendered until the player moves around the occlusion cube and regains line-of-sight to it.

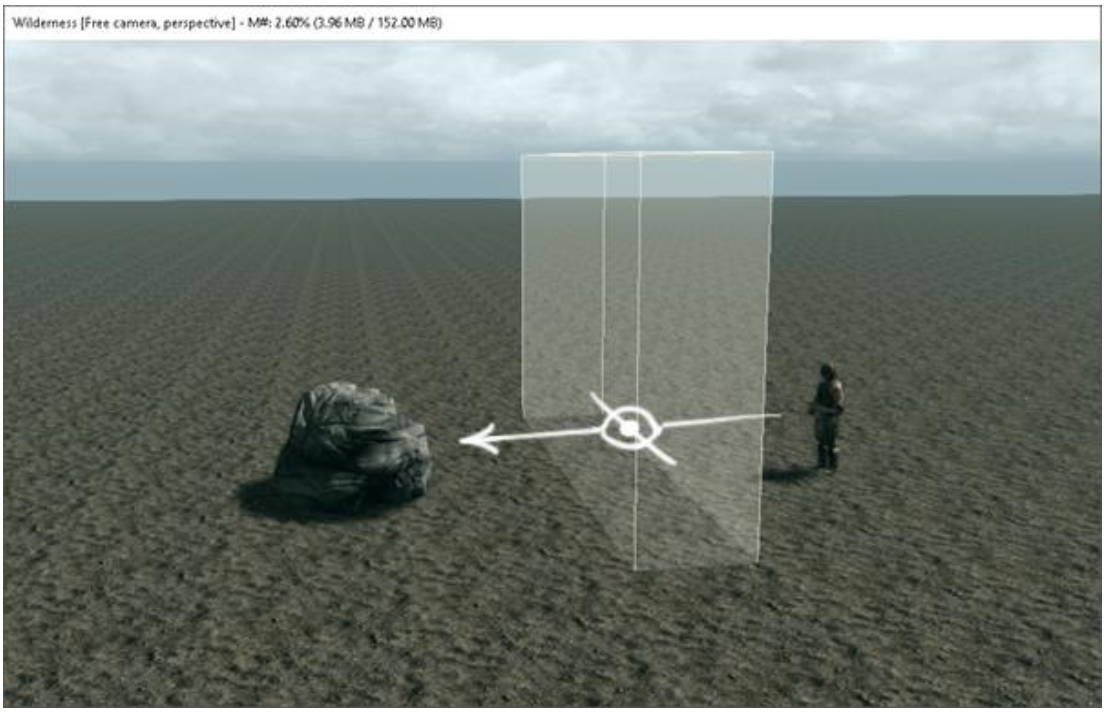

Figure 265 - The rock is occluded based on the player's current position.

Note: The occlusion geometry itself is invisible to the player.

Occlusion geometry can be created around a selected object. In this example I'm selecting one of the town houses in Stonehollow.

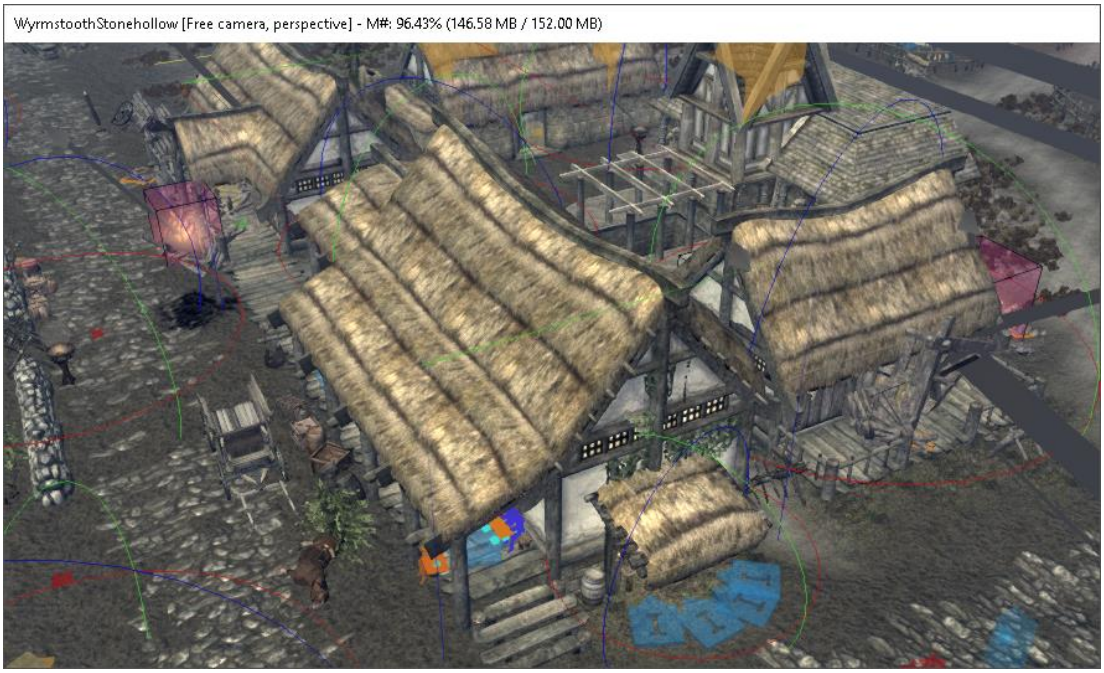

Figure 266 - The object to add occlusion geometry to.

Next, click on the Occlusion Cube button in the toolbar to fit an occlusion cube around the object. The occlusion cube should show up as semi-transparent white cube in the render window.

If nothing appears, press 'M' to toggle markers. If the occlusion cube still isn't showing, go to View > Show/Hide Window and make sure 'Occlusion Planes' is ticked.

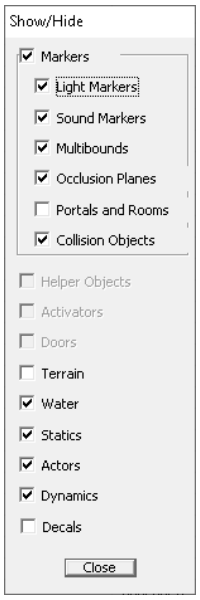

Figure 267 - Show/Hide Window.

The resize gizmo should be automatically enabled when an occlusion cube or occlusion plane is added, but if it isn't, press '2' to toggle it on or off.

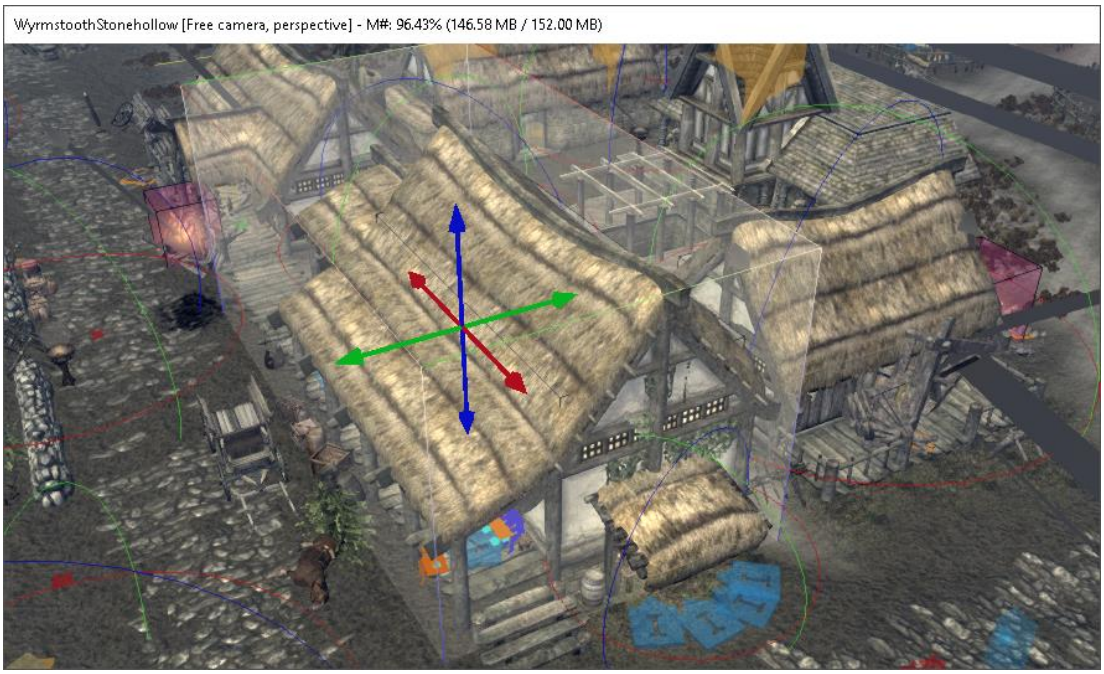

Figure 268 - Occlusion cube.

Important: Use the resize gizmo to resize the occlusion cube so that it's hidden within the geometry of static objects. You should avoid having any part of the occlusion geometry sticking out.

In my example below, I lowered the occlusion cube below the part of the house where the roof starts so it isn't sticking out. I also extended it into the ground a bit to ensure ground-level objects behind the house are being occluded properly when the player walks around it.

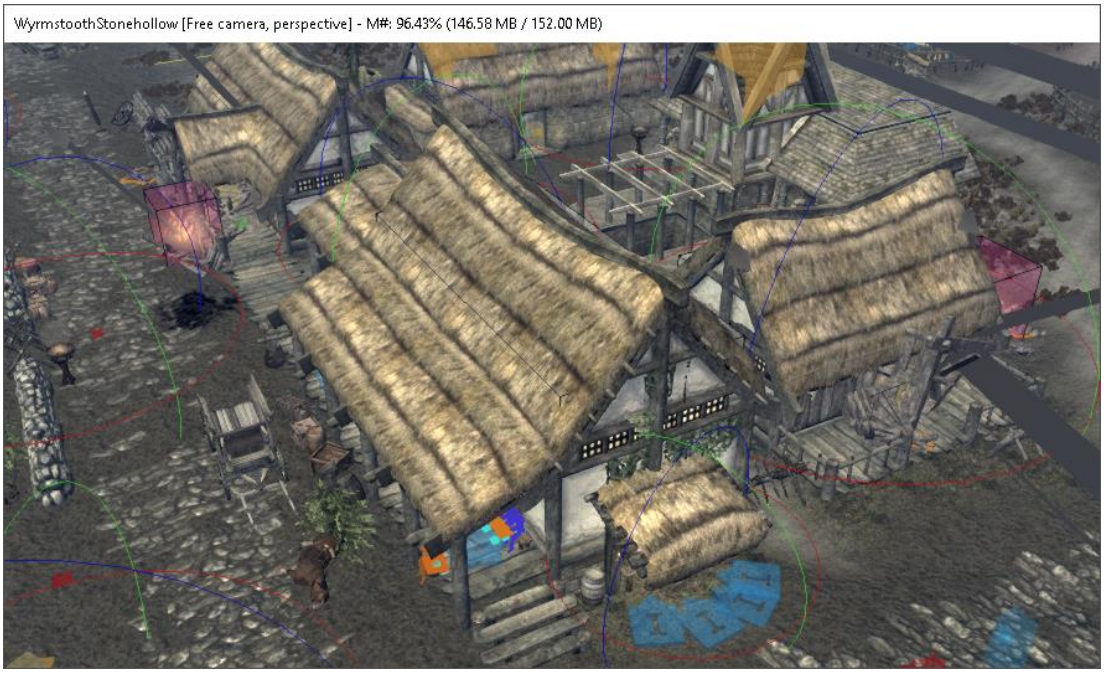

Figure 269 - Occlusion cube fitted to a farm house.

If I raise the house up into the air you can see how the occlusion cube was positioned.

Figure 270 - House lifted up to show occlusion geometry.

If we take a look under the ground plane, you can see how far down I extended the occlusion cube.

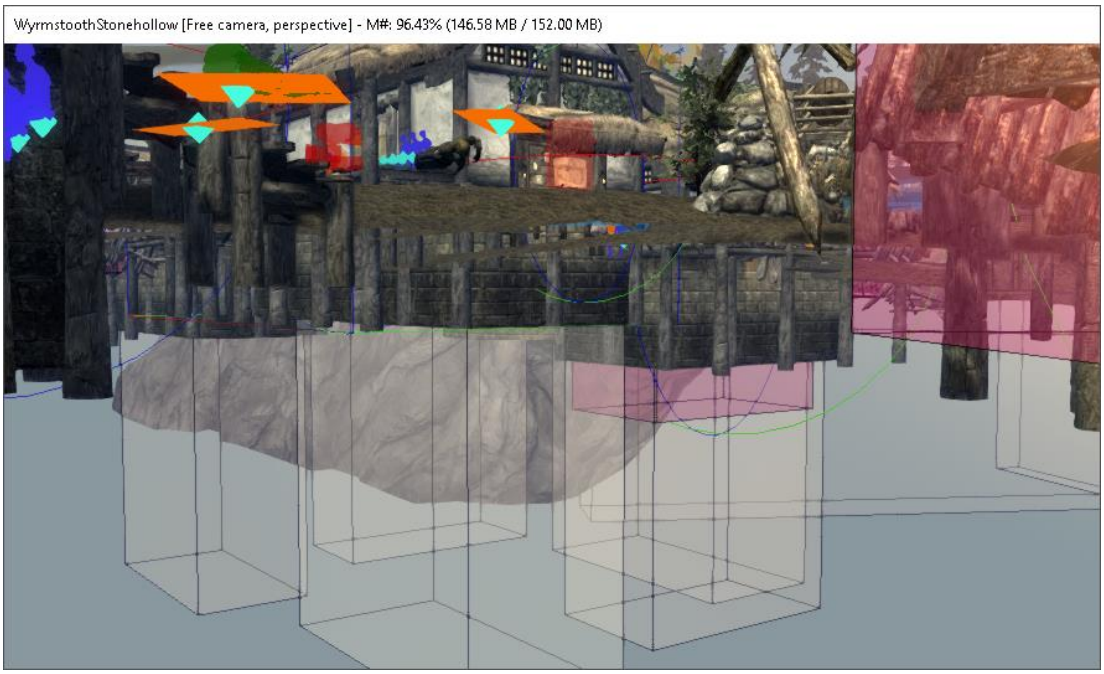

Figure 271 - Occlusion cube extended into the ground.

Occlusion geometry can be used in interiors as well to help occlude portions of a cell that are difficult to box in with roombounds.

Important: Don't add too many occlusion cubes or occlusion planes. The game needs to calculate what objects to occlude, so having a lot of occlusion geometry in a small concentrated area can actually be deleterious to performance.

Once you've added occlusion geometry, I'd recommend walking around in-game with an FPS counter like Fraps to confirm FPS gains instead of losses. If performance is worse after adding occlusion geometry, you might need to rework it or remove it.

In the next example you can see how I hid an occlusion cube within the walls of Fort Moonwatch to occlude geometry outside the walls when the player walks into the courtyard.

Figure 272 - Fort Moonwatch wall.

And there's the occlusion cube hiding in the fort's walls.

Figure 273 - Wall piece raised to reveal occlusion cube within.

CLUTTERING A WORLD SPACE

The art of level design could be a separate book unto itself. For this section I'm going to try and keep things terse by showing you how I approached this task during the development of Wyrmstooth with some specific examples. If you're looking for information on how to set up region-based automatic cluttering, see the section on Region Generated Textures and Objects.

Note: Personally I would recommend cluttering your world space manually by hand versus region-based automatic cluttering. Even though that means hand-placing every single object, in my opinion it's easier to make a more organic-looking landscape. That said, you may find automatic cluttering useful for placing some initial objects down to help you get started.

Before you begin, know what you want to achieve. Whether that's from a rough sketch of the world space, a list of ideas, photos, and/or professionally drawn concept art. I would strongly recommend having something to reference from first.

Important: Cluttering a world space is probably the most time-consuming part of making a new lands mod. The last thing you want to do is delete what you've already made because you changed your mind about the design or tone you're trying to achieve.

Level design usually begins at the blocking out phase. Blocking out is the process of determining the playable area, shape and flow of a 3d map. In other game engines such as Unreal this is usually done with proxy geometry but in Skyrim we have the benefit of already having assets ready to be used.

I would recommend you begin blocking out your world space by starting with the biggest pieces first. Start with mountain peaks and mountain cliffs, then work down in scale leaving the smallest objects to last. Lakes and rivers can also be useful in dividing up your world space.

Figure 274 - Mountain peaks and mountain cliffs.

You should approach level design as a series of 'passes'. Your first pass might involve placing mountain peaks, mountain cliffs, lakes and rivers to split up your world space into distinct regions. The next pass after that might involve making a start on the largest points of interest on your map such as cities, towns and villages - even if it's only building placement at this stage. Then work down in scale from there.

Important: By splitting up a seemingly insurmountable task into a series of subtasks, you make the work more manageable.

If you're working with a team of level designers, split your world space up into a series of regions first to divide the work between yourselves. Refer to the section titled Version Control and Merging Changes to collate your work back into a single master file.

In the screenshot below you can see where I placed mountains to loosely separate the Wyrmstooth world space up into several distinct regions, such as the Western Forests, the Steampools at the center of the map, the Northern Marsh, the Eastern Glacier, and the ring of snow-capped mountains around the centre.

Figure 275 - Splitting a world space up into several distinct regions.

Mountains will also help reduce the amount of overall cluttering you'll need to do by covering a lot of your map! ☺

Note: When placing mountain ranges, try and avoid straight lines. Try and be mindful of how your world space is going to look in the map screen once you've built LOD.

Take some inspiration from real-world maps when working out the layout of your world space.

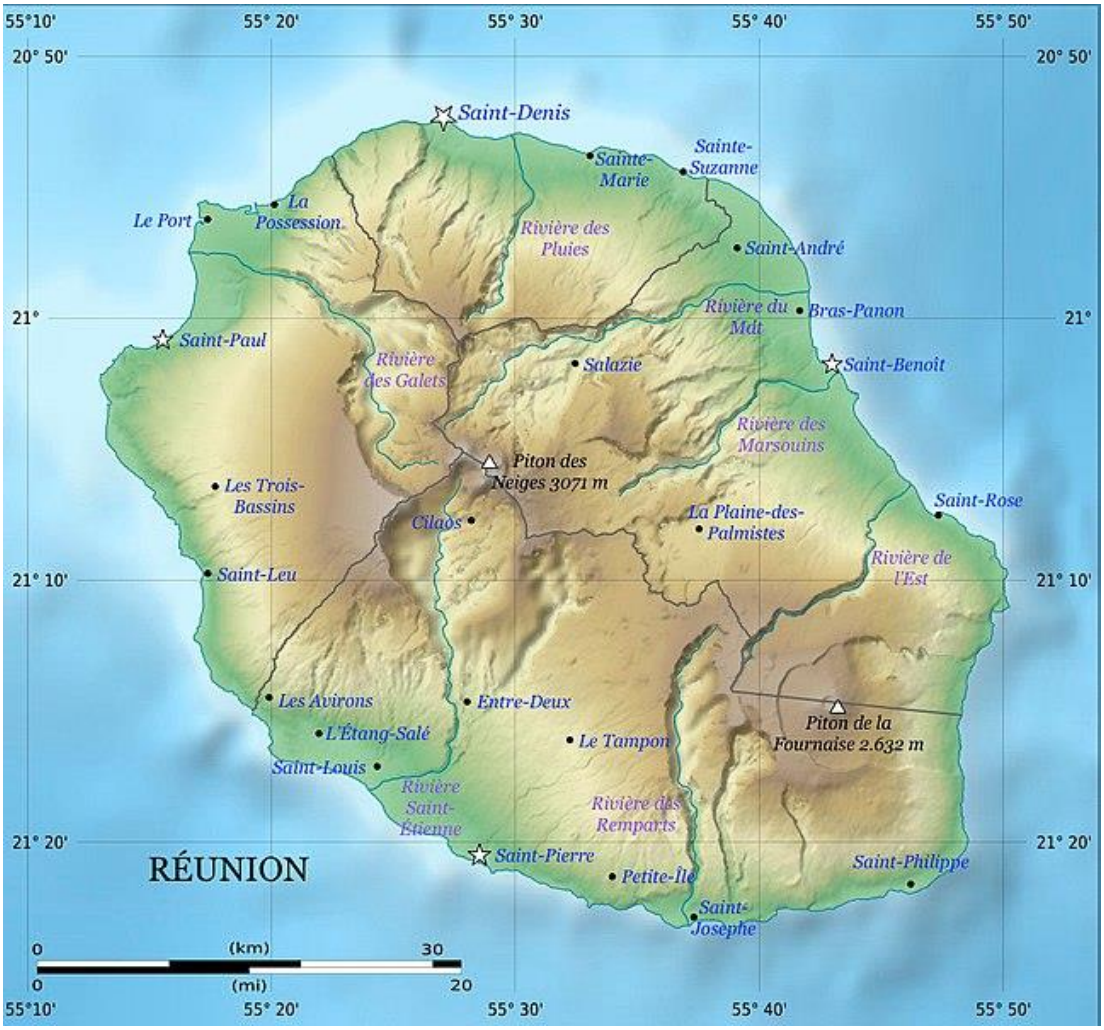

Figure 276 - Map of Reunion Island.

For Wyrmstooth, I took some inspiration from real world volcanic islands such as Reunion Island.

Medium sized objects such as the MountainCliffSlope and MountainTrim variants can be useful for blending mountain peaks and mountain cliffs with the ground as per the screenshot below:

Figure 277 - MountainTrim and MountainCliffSlope variants used to cover the base of a mountain.

Generally you'd want to cover the intersection between a mountain peak or mountain cliff and the ground layer. Rather than having mountains simply stick out of the ground, I like to surround mountains with smaller details to simulate erosion and rock falls.

Over time, rocks and boulders would've broken away from cliff sides and mountain peaks, coming to rest in the valleys or plains below. MountainTrim variants are also useful for quickly adding smaller rock detail.

Holding down the 'Z', 'X' or 'C' keys while right-click dragging an object in the render window will constrain rotation to an axis. Giving these objects a little bit of rotation will help make them look a bit more visually distinct from each other. I would also recommend adding some random scaling. You can toggle the scale tool on or off by pressing '2'.

You can also change an object's scale in its reference properties which you can get to by double-clicking or right-clicking on the object in the render view and selecting Edit.

You can change the Scale value under the 3D Data tab.

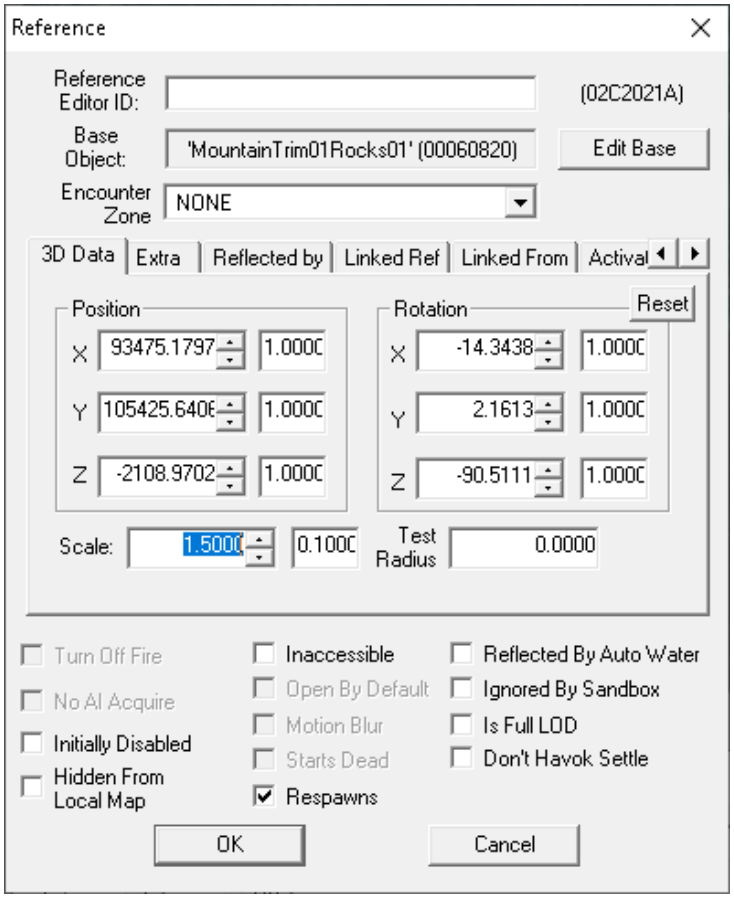

Figure 278 - Changing the scale of an object.

I would avoid increasing scale beyond 2.0000 to prevent stretching the textures too much.

Next let's have a look at adding roads.

In the Object Window, filter by 'road'.

When adding roads, I like to start with the larger pieces first, such as RoadStraight02, RoadCurveLong45R01 or RoadSCurveR01. Leave some gaps in between these pieces.

Once those are down, fill the gaps in-between with smaller road pieces such as RoadChunkL03, RoadChunkM01 and RoadChunkM03.

This will help make the road look like it has been worn down with time.

Road pieces are very flat so you might have trouble winding a road over a hill with the larger road pieces. Use the smaller road pieces for that instead.

Figure 279 - Old worn road.

Use the landscape edit tool to raise the landscape up over the sides of the road to make the seam between the land and the road less regular.

One trick for hiding the seam between the landscape and the road is to place rocks, thickets or bushes over it to make it less noticeable.

Figure 280 - The road to Wyrmstooth Barrow.

In snowy landscapes, you can even cover portions of the road with the landscape itself to simulate snow accumulation.

Now that we've divided our landscape up a bit, let's start filling the wilderness in-between.

The main technique I use for doing this is to develop 'islands of detail'. Maybe start with a big object like an old tree stump and surround it with smaller objects like rocks, bushes, thickets or smaller trees.

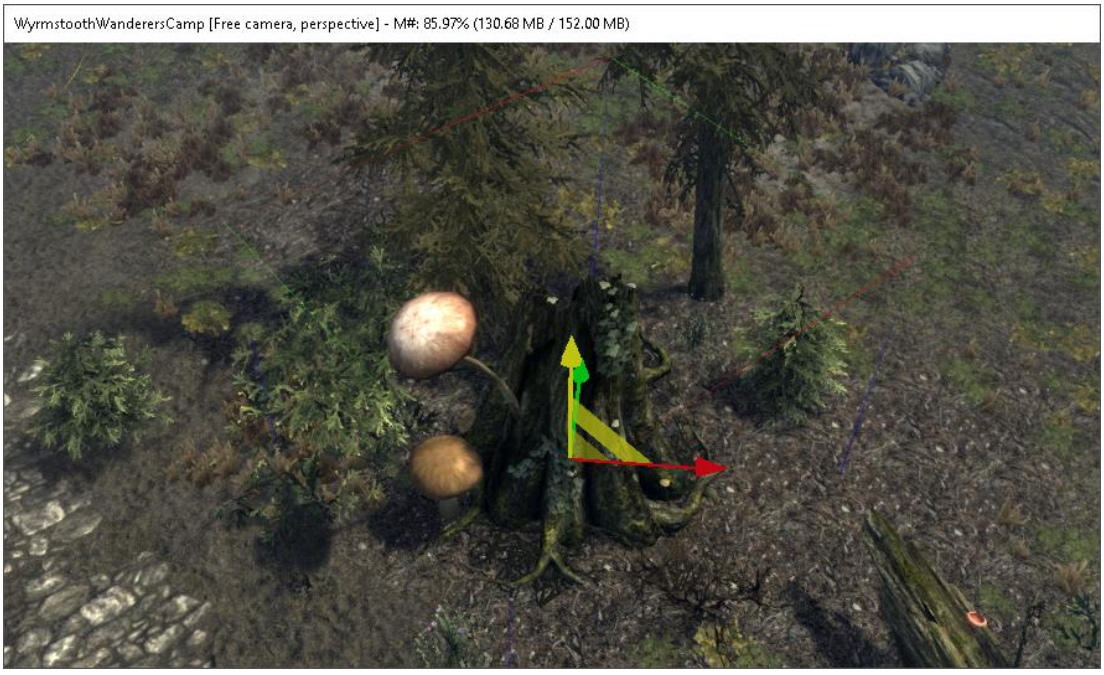

Figure 281 - An island of detail around an old stump.

You can then fill in the areas between these islands to blend them together.

Figure 282 - An island of detail around a tree.

Large objects like DirtCliffsIsland01PineForest01 or TundraStreamBend01PineForest02 can also help seed islands of detail.

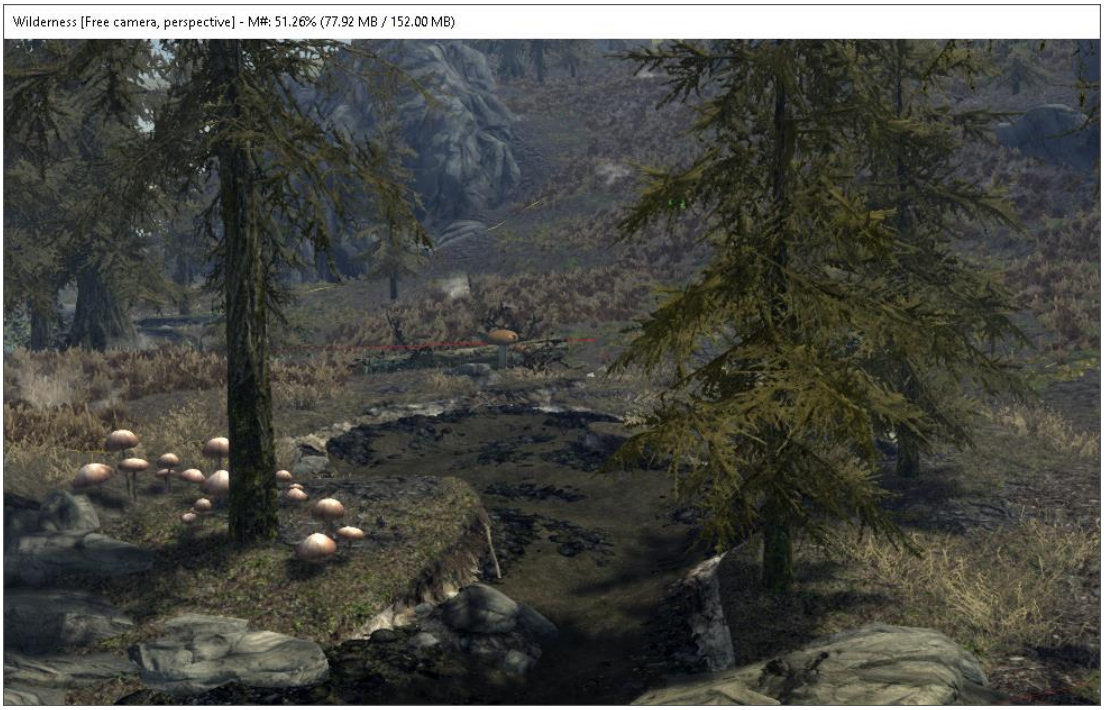

Figure 283 - TundraStreamBend01PineForest02.

TundraStreamBend01PineForest02 is normally used to create small streams, but it can also help add variety to your landscape without water too. Maybe a stream once flowed here but dried up long ago.

Important: Let the details you add to a landscape tell a story of their own. This concept is called Environmental Storytelling.

Consider the fact that Skyrim isn't a fast-paced game and players have the freedom to explore the world at their own leisure. Good environmental storytelling helps build the player's immersion with your world space.

For coastlines I like to use TundraPond01Coast1 and blend it with the LCoastBeach01 texture to create these muddy pools where creatures such as mud crabs may reside. I also added driftwood along the shore, perhaps recently washed ashore by the tides.

Figure 284 - Coastal pools.

Some objects have several different variants with different textures or shader effects like snow or sulfur. For example, for placing rocks in water use the Wet variant. E.g.: RockL01Wet.

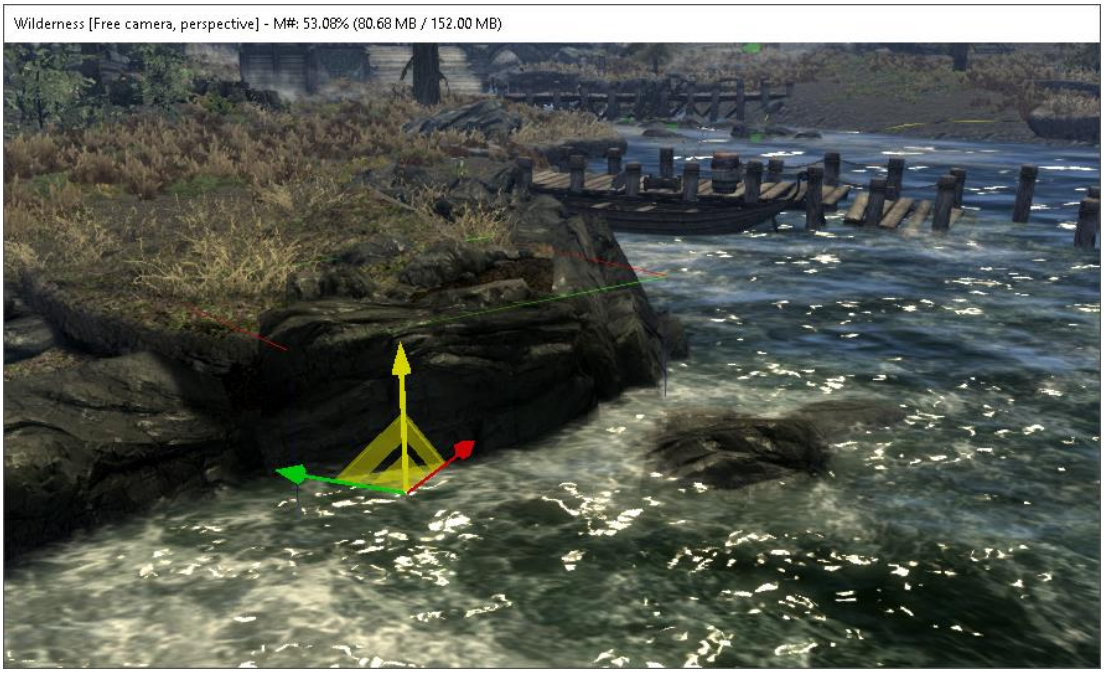

Figure 285 - RockL05Wet.

Medium sized objects such as DirtCliffsIsland01PineForest02 can be useful for adding some unevenness to the landscape. The problem however is that grass is only populated on the landscape.

To try and fix this you can use thickets to cover these bald areas.

Figure 286 - TreeThicket01 covering DirtCliffsIsland01PineForest02.

Figure 287 - Blending automatically generated grass with manually placed thickets.

Don't forget to clutter the ocean floor if your world space has a coastline.

Start with rocks and boulders like MountainTrim02CoastOceanFloor01, RockPileL04CoastOceanFloor01 or MountainTrim01CoastOceanFloor01 then add smaller objects around then such as RockPileM02CoastOceanFloor01 or RockPileL02CoastOceanFloor01.

Figure 288 - Ocean floor cluttering.

In the screenshot above, I painted the LCoastOoeanFloor01 texture in between the rocks to place areas of kelp along the ocean floor.

A few underwater shipwrecks can be found along the coast. Barrels and crates that were lost in these wrecks can also be found scattered along the ocean floor for the player to loot. Nordic barnacles can be found attached to the sides of these old wrecks, and slaughterfish use them to lay clumps of eggs in sheltered nooks.

Adding points of interest can help break up the monotony of the wilderness. These may be small camps, ancient ruins, remnants of houses that have been destroyed, and so on.

Here are some points of interest I added around Wyrmstooth to give you some ideas:

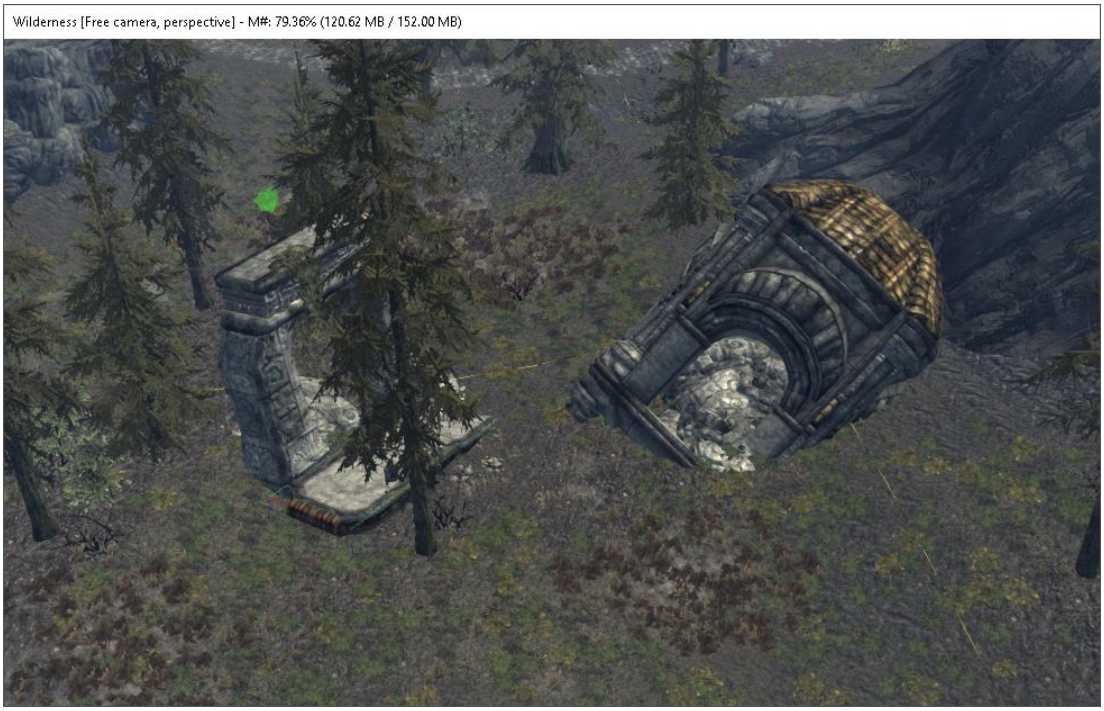

Figure 289 - A small dwemer ruin.

Figure 290 - A small dock and camp on the shore.

In the screenshot below, I repurposed WHshorttower to make a monument for a grave.

Figure 291 - Grave of an unknown warrior.

Don't be afraid to repurpose existing assets.

Figure 292 - A boat covering a make-shift shack.

As humid air is forced up the side of a mountain it condenses into clouds. We can simulate this effect by manually adding in these clouds. This can also be used to help exaggerate the height of the mountains, making them seem like they're poking through the cloud layer.

Filter by 'INV_' to get a list of all cloud shapes that you can manually place.

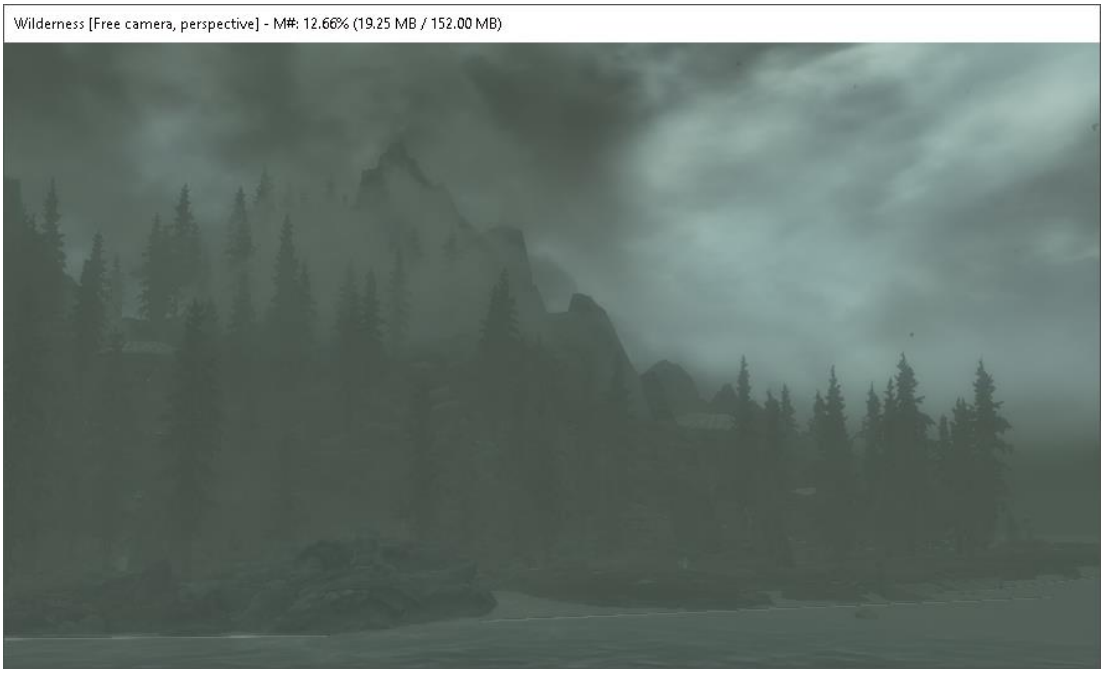

Figure 293 - Clouds along a mountain side.

Clouds placed at ground level may look like a bank of thick fog, but it's not a volumetric effect.

Figure 294 - Clouds at ground level.

Normally used in dungeons, you can repurpose the FXMist variants to add a thin layer of ground-level fog.

FXMist variants are found under WorldObjects > MoveableStatic in the Object Window.

Figure 295 - FXMistLowSmokey01HalfVis.

To add a rolling fog effect, I scaled up a customized version of FXVolumeMist. FXVolumeMist is a generator that spawns 'fog' geometry as a particle effect.

Figure 296 - FXVolumeMist.

To add birds to the sky I used FXbirdOPreyNoNestACT which is found under WorldObjects > Activator under in the Object Window.

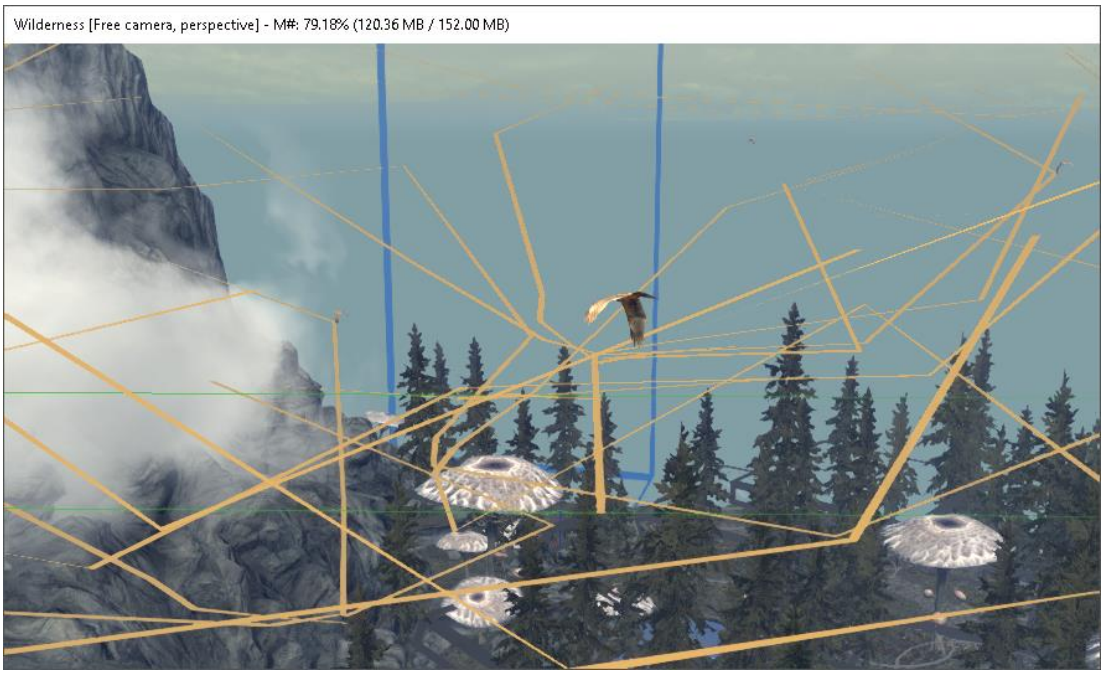

Figure 297 - Birds.

These are simple objects that follow the yellow outlined path.

Figure 298 - More birds.

When placing waterfalls, build up the sides of the waterfall with rocks to help make them look a bit more believable.

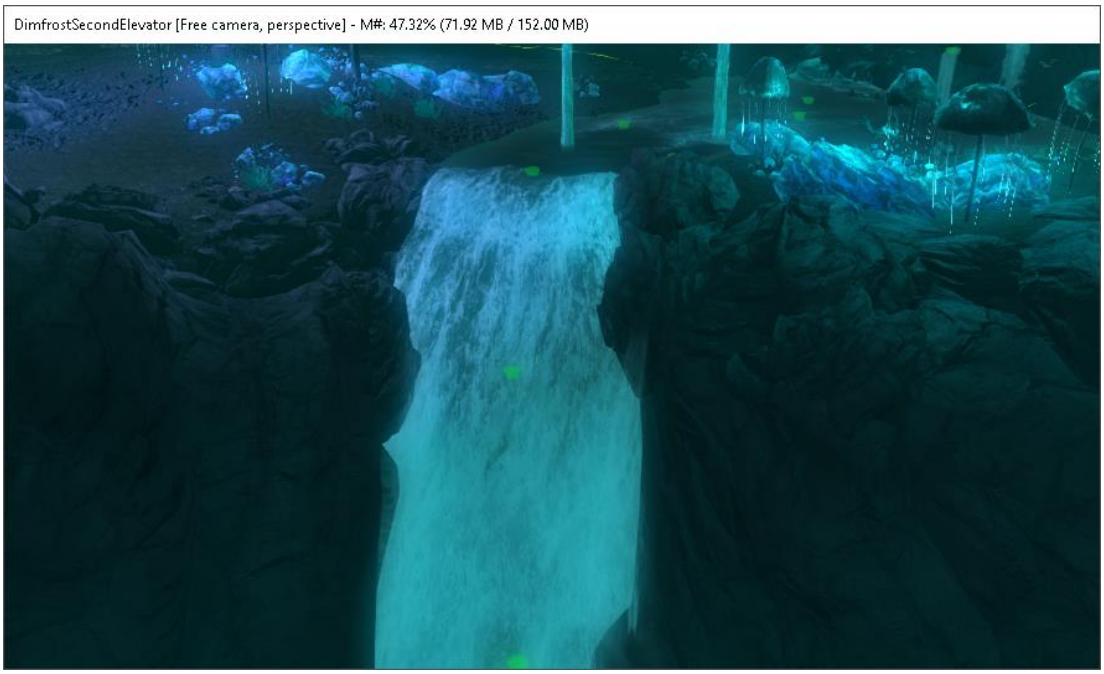

Figure 299 - A waterfall in Dimfrost.

This is to help simulate the fact that over the centuries, the force of the water would've begun to cut away at the cliff side.

Use FXWaterfallSkirtTallFront to simulate the mist at the bottom of a waterfall.

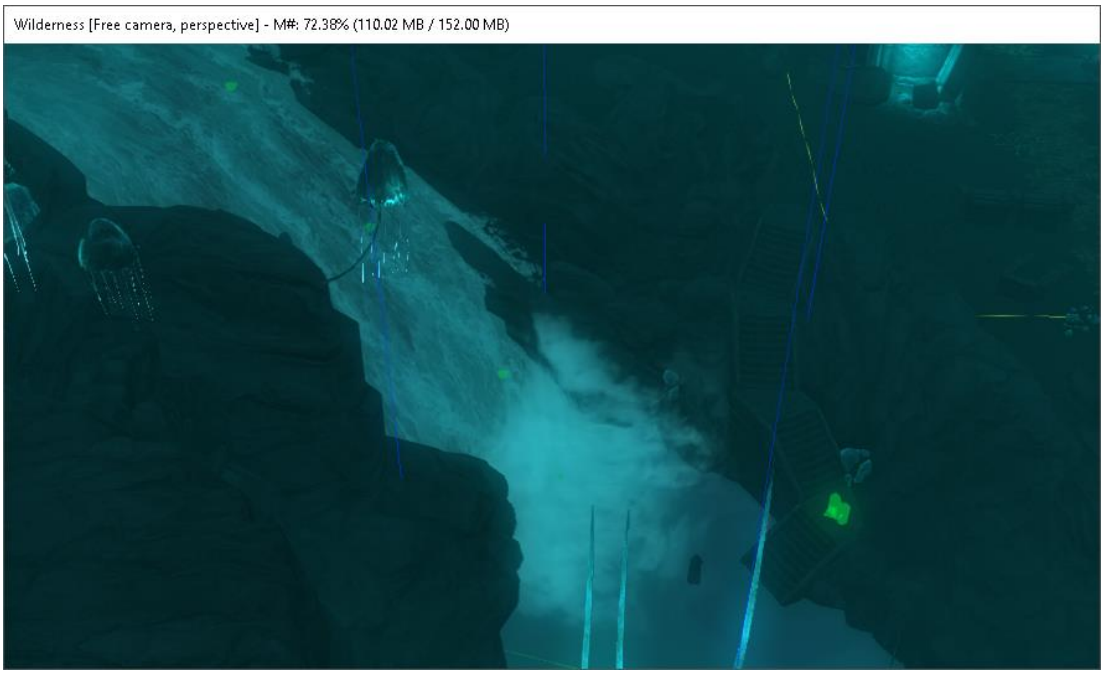

Figure 300 - FXWaterfallSkirtTallFront.

Important: As you clutter the world space, it's important to test in-game fps.

Just keep in mind: the more objects you add to each cell, the more geometry the game engine has to render, and the choppier your framerate will become.

You can use a program like fraps to display an fps count.

I aimed to keep in-game fps close to or at 60 fps.

Figure 301 - A screenshot from fraps showing the fps counter.

There are ways to mitigate low framerates by hiding objects from being rendered if they are obstructed from view.

See the sections on Adding Occlusion Geometry and Generating TVDT Occlusion for more information.