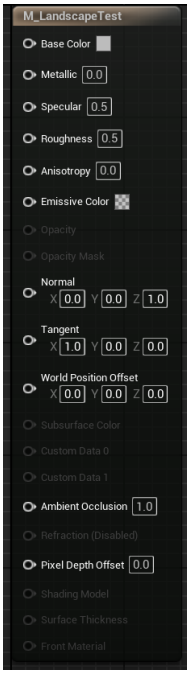
Believer Master Material Workflow

This document is the source of truth for the current state and training materials for using Master Materials in Unreal Engine at Believer.

General Workflow Structure

Materials are an asset type that instruct different surfaces, geometry, cards or the screen itself how to shade/light and behave. In UE5 the default structure for materials is to instruct PBR (physically-based rendering) channels via math and/or textures:



Material channel stack from inside the material editor.

Official Documentation on Materials

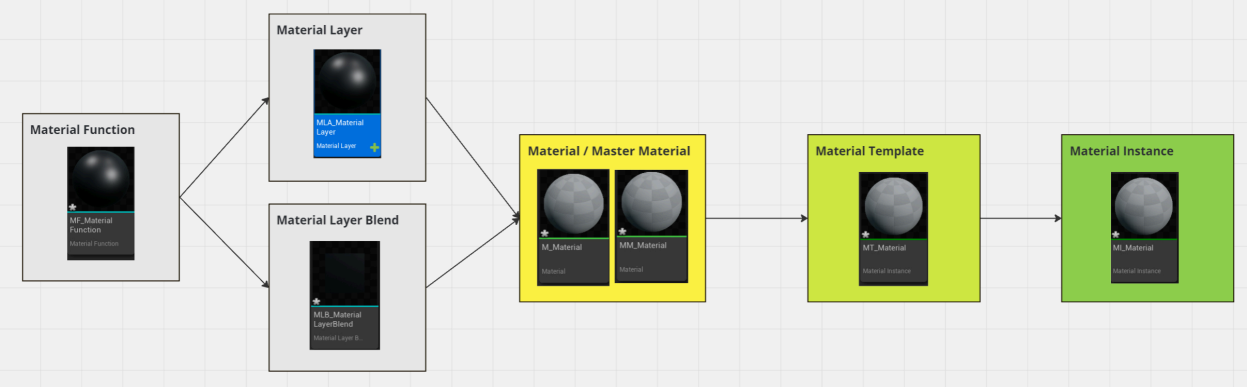
Unreal Engine Materials | Unreal Engine 5.4 Documentation | Epic Developer Community

Controlling the appearance of surfaces in the world using shaders.

https://dev.epicgames.com/documentation/en-us/unreal-engine/unreal-engine-materials?application_version=5.4

In our workflow at Believer, for most art teams we will use a series of modular material features (material functions), material layers, material layer blends to create material templates and artist-facing material

instances. All of these are different asset types in Unreal, with different interfaces for working with them.



Material Function	**Material Layer**	**Material Layer Blend**	**Material / Master Material**	**Material Template**	**Material Instance**
Created/Owned by: Tech Art	**Created/Owned by: Tech Art**	**Created/Owned by: Tech Art**	**Created/Owned by: Tech Art / Art (VFX/UI)**	**Created/Owned by: Tech Art**	**Created/Owned by: Artists**
Material functions are a re-usable custom material node that allows for inputs and outputs. They can also be used as "wrappers" for a "Master Function" where you want a set list of functionality but may need some settings to be different at the Material level. Examples: Exposing tiling settings for a texture, allowing an artist to re-color part of a texture.	Material Layers (Prefixed by MLA_ are a special type of Material Function that can be added and re-used multiple times in one material or material instance as part of our Layer-based workflow.	Material Layer Blends (Prefixed by MLB_) are a special type of Material Function that is used to define the blending math between top/bottom material layers.	Master Materials (Prefixed by MM_) Materials that contain a robust set of reusable functionality that are constructed in a modular manner using Material Functions, Material Layers and Material Layer Blends. (One-Off) Materials (Prefixed by M_) are more for special cases where re-usable functionality does not cover the look development needs such as a particular VFX or UI. These may or may not be created with	Material Templates (Prefixed by MT_) are Material Instances that are pre-configured with commonly used settings or asset classes to make iteration for art teams faster. **Note: Material Templates aren't a real asset type, they're still MI, just named different to demonstrate that they are a starting point.** Example: A material template for Environment Trim Sheets that's preconfigured to contain the features and layers that are	**Material Instances (Prefixed by MI_) are the artist created assets used to assign to individual 3d models. They contain all the functionality and Dev UX needed to execute an asset without any of the worry or hassle about dealing with material math, performance, platform support, etc. (Which is handled at the Material level by Tech Art).**

			Material Functions.	most obvious for Trim sheet material instances.	

Overview of Material-related Assets (Video)

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/eb47d697-026a-4341-a971-50432da30b24/materialassetoverview.mp4

Workflow Training

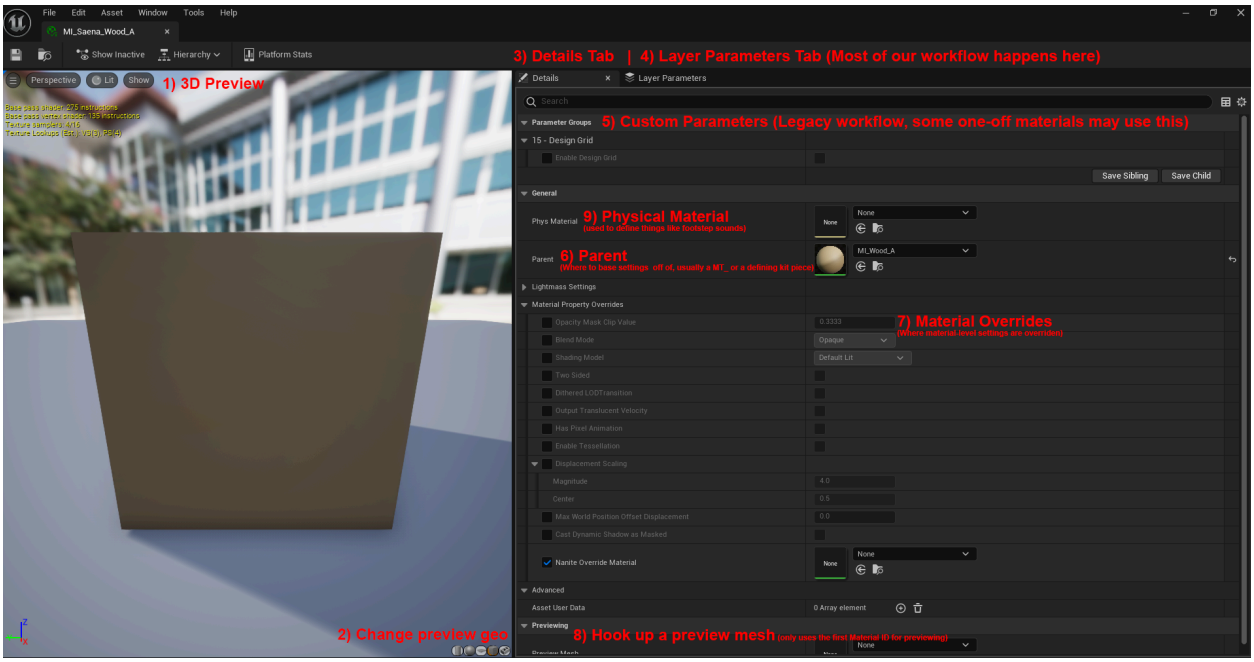
Material Instance Basics

Creating and Using Material Instances in Unreal Engine | Unreal Engine 5.4 Documentation | Epic Developer Community

Guide for settting up and using Material Instances in Unreal Engine.

https://dev.epicgames.com/documentation/en-us/unreal-engine/creating-and-using-material-instances-in-unreal-engine?application_version=5.4

Working with material instances is the primary way you will define how an asset looks via textures, floats, colors and checkboxes and a robust feature set. Familiarity with the interface and its capabilities will expand creative power so let's cover it:



Material Instance Interface in Unreal

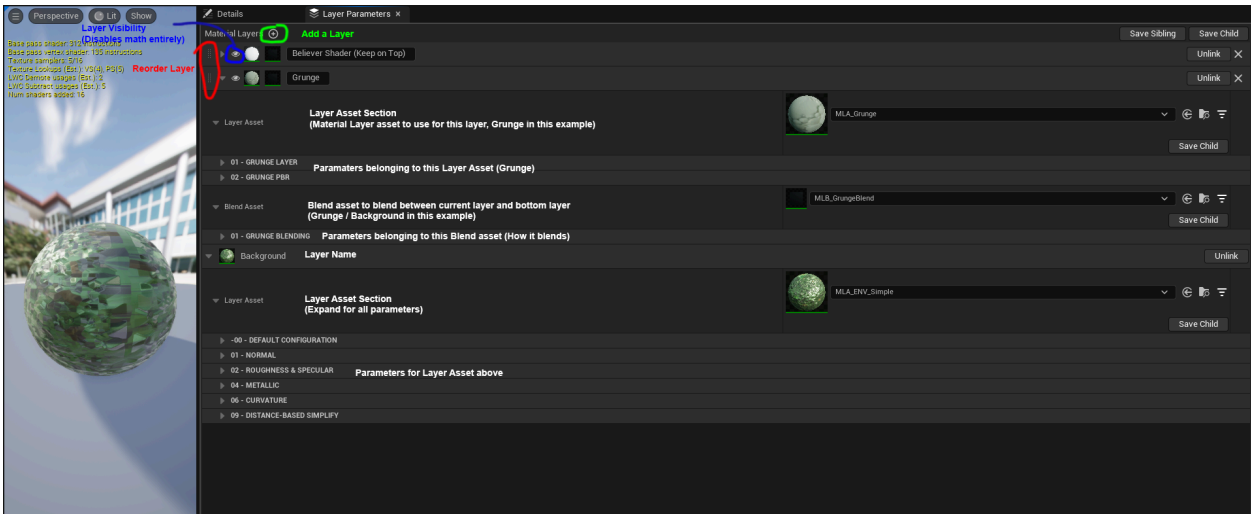
Material Instance UI/Basics (Video)

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/652da04e-38eb-4e19-bdec-f09ce8bf9f4a/MIUIoverview.mp4

Overview of the Material Instance Interface in UE5. This just covers where things are and is not specific to our workflow but more of how it functions in Unreal.

Working with Material Layers (Video)

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/dc252f12-7ac4-4b55-abf6-7a2a5d1761d9/mat_MLBasics.mp4



Full Workflow (Part 1): Creating a new Material Instance

There are two ways to create a material instance. Use whichever you prefer. Tech Art recommends Method #2 because it does not require any moving of files, but it is a soft recommendation.

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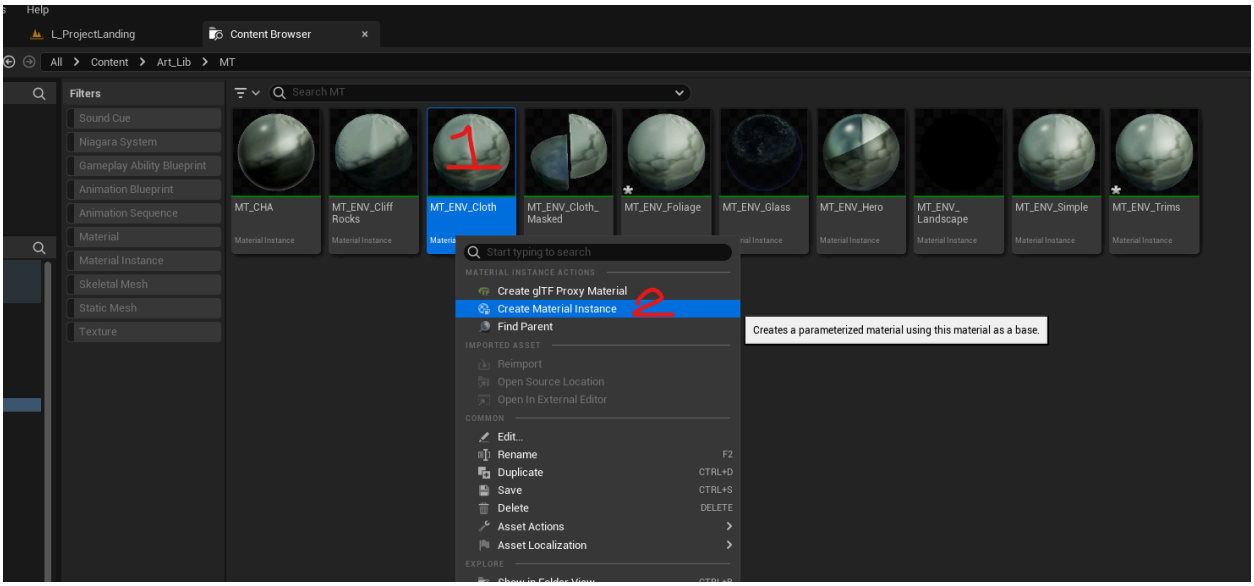
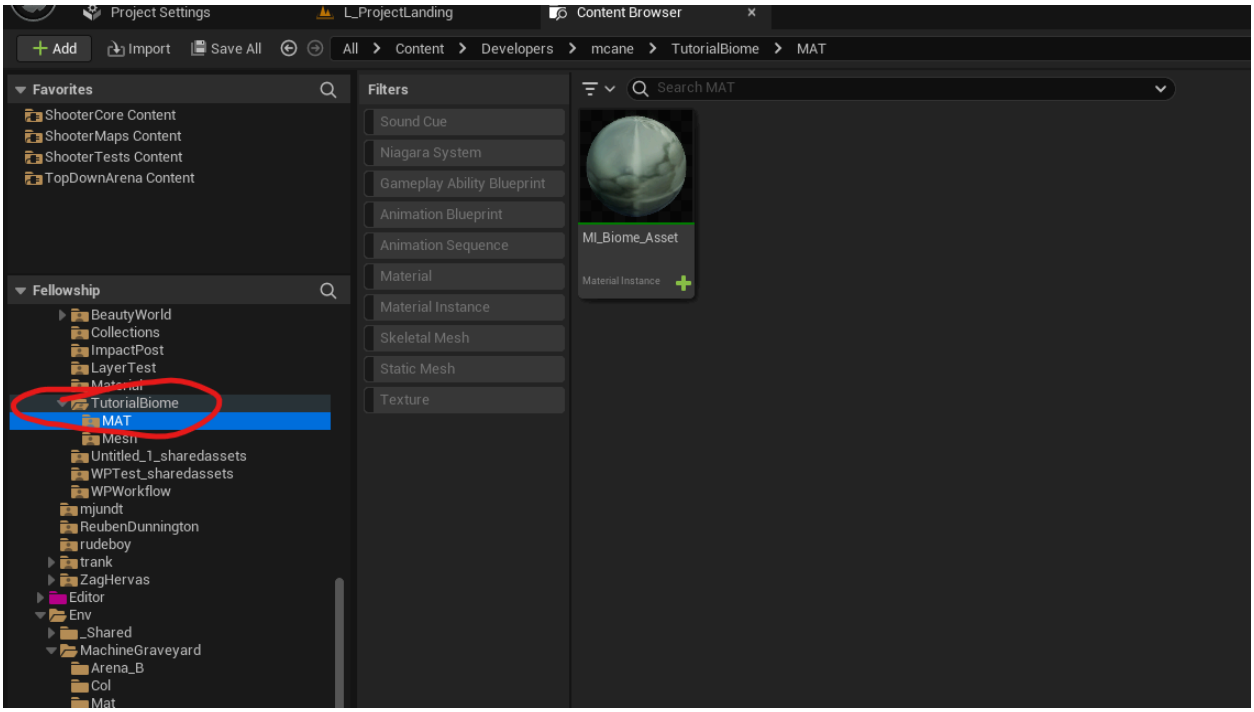
Method #1



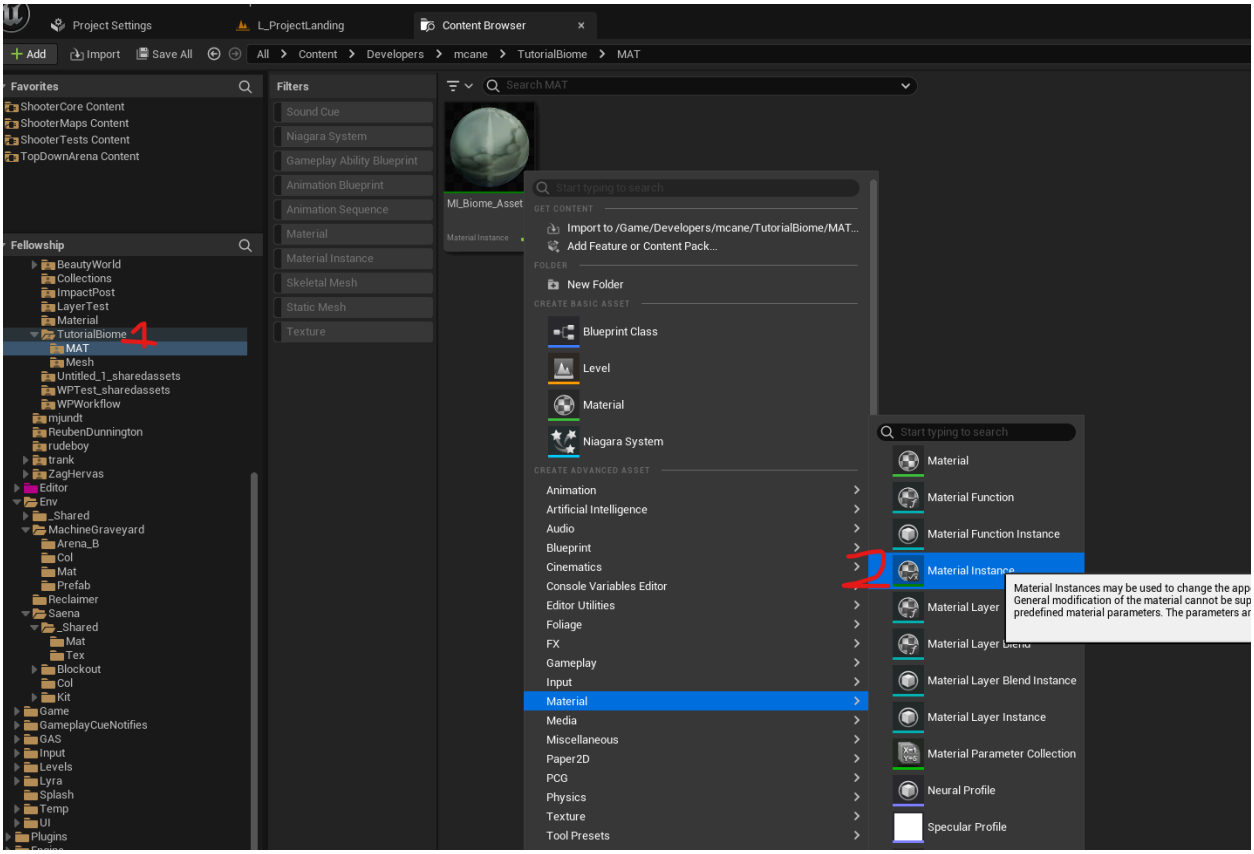
1. Select the material template based on what type of asset you are making the Material Instance for.
2. Right Click on the tile → ***Create Material Instance***
3. Name your material instance according to:

📁 Unreal Project Naming/Folder Conventions

4. Click+Drag the new material instance and move it to the proper folder associated with the asset (Ex: ENV/Saena/Mat)



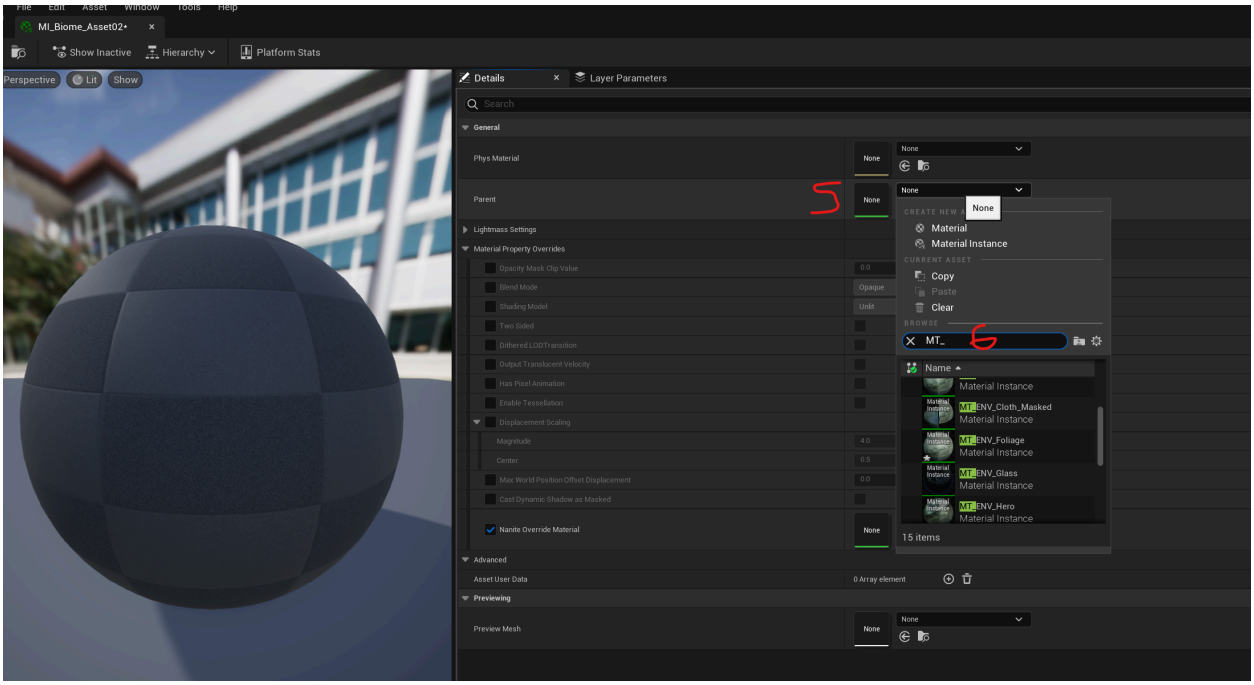
Method #2



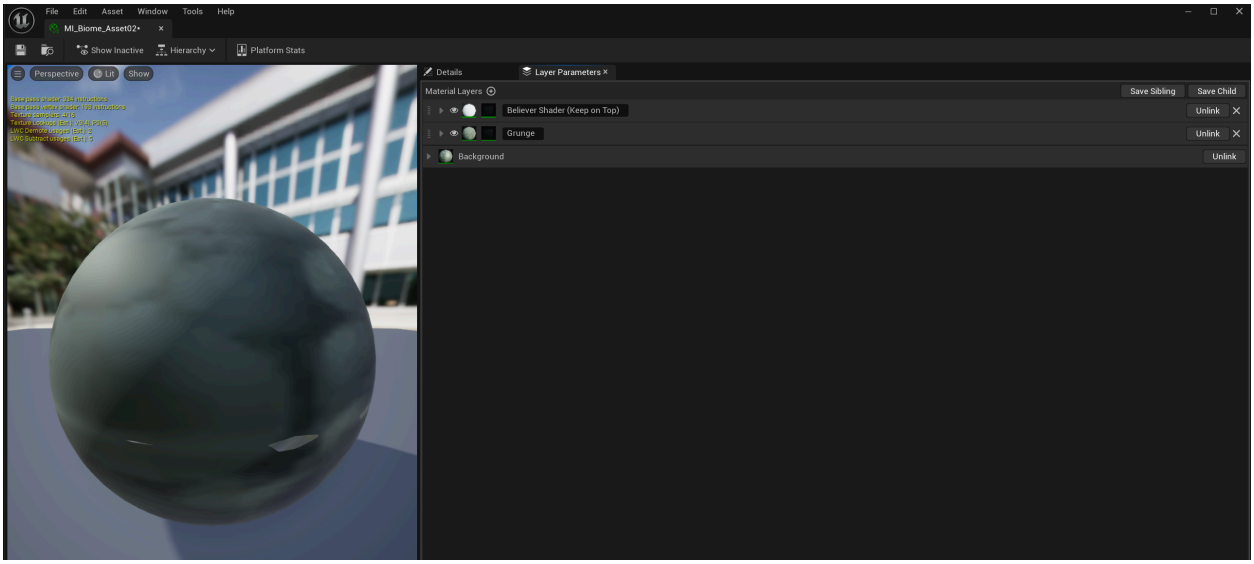
1. Navigate to the /MAT/ folder associated with the asset you're making the Material Instance for. (Ex: /ENV/Saena/Arch/MAT)
2. In the asset area, right click → Material → Material Instance
3. Name your material instance according to:

📁 Unreal Project Naming/Folder Conventions

4. Double click the new Material Instance to open it.
5. Find the setting called ***Parent***.
6. From the dropdown type "***MT_"*** to filter only material templates. Choose the one you want to use.



7. Switch to the ***Layer Parameters Tab*** - Now you're ready to work.

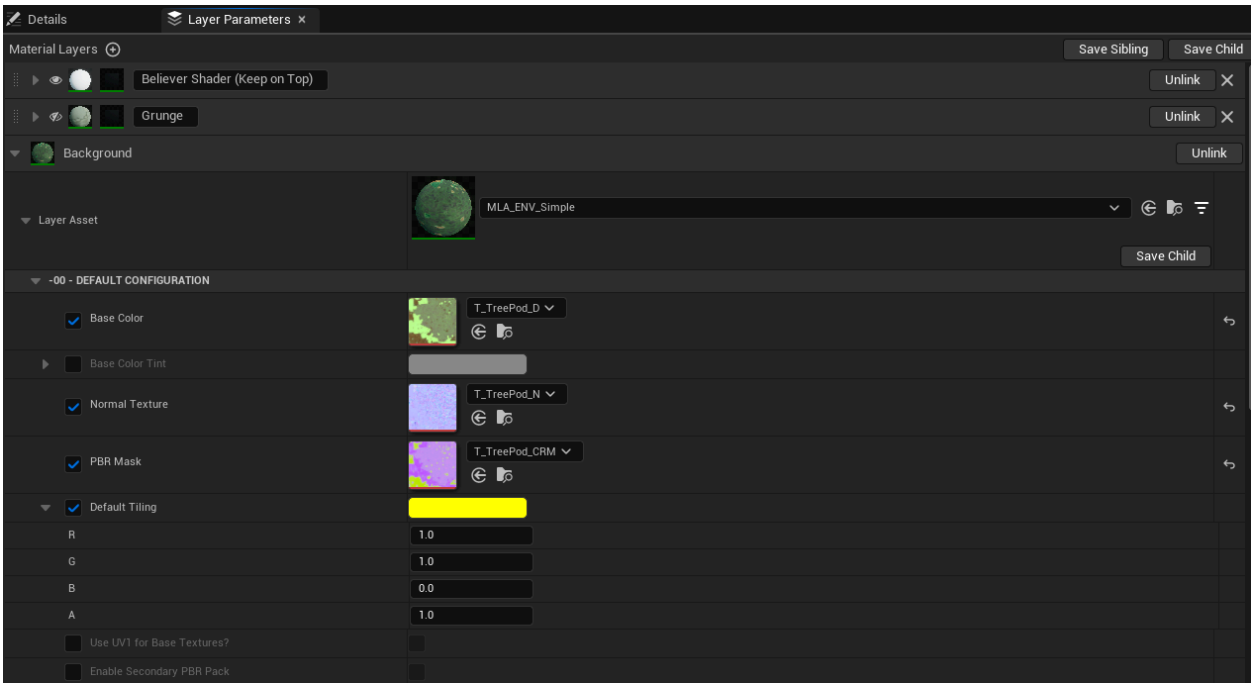


Full Workflow (Part 2): Base Material Instance Setup

Regardless of what material template you start with, the base configuration is mostly the same and involves hooking up your texture set and tweaking PBR parameters.

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/4f38840e-cfc0-4cf6-9083-123b50ac6e58/mat_pt2_baseMIsetup.mp4

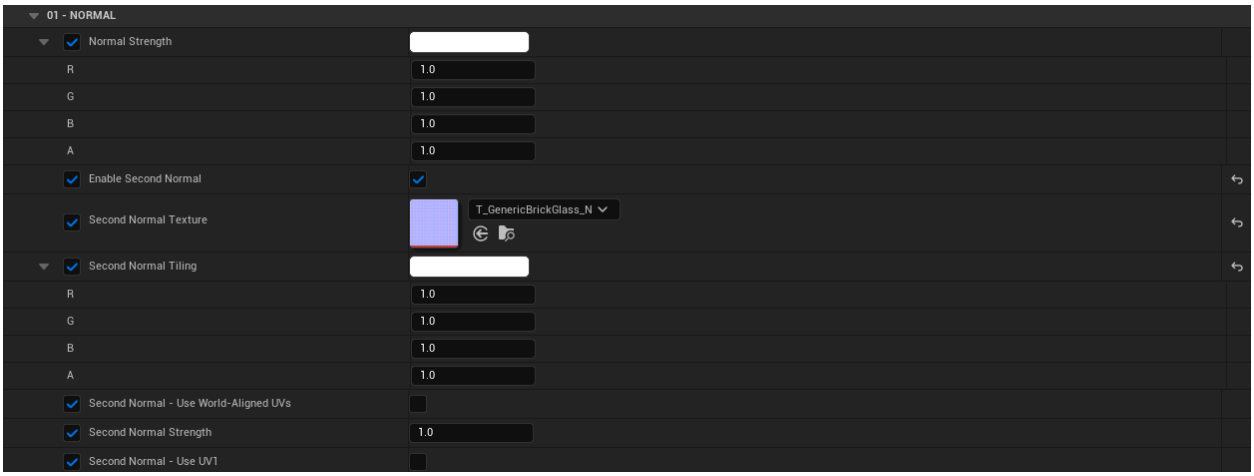
Default Configuration Section



The default configuration contains the basic settings to hook up your texture set, and some options for enabling a second RGB pack and whether to use UV0 or UV1 for those textures.

REMEMBER: You have to check the box to the left of the setting to override the value.

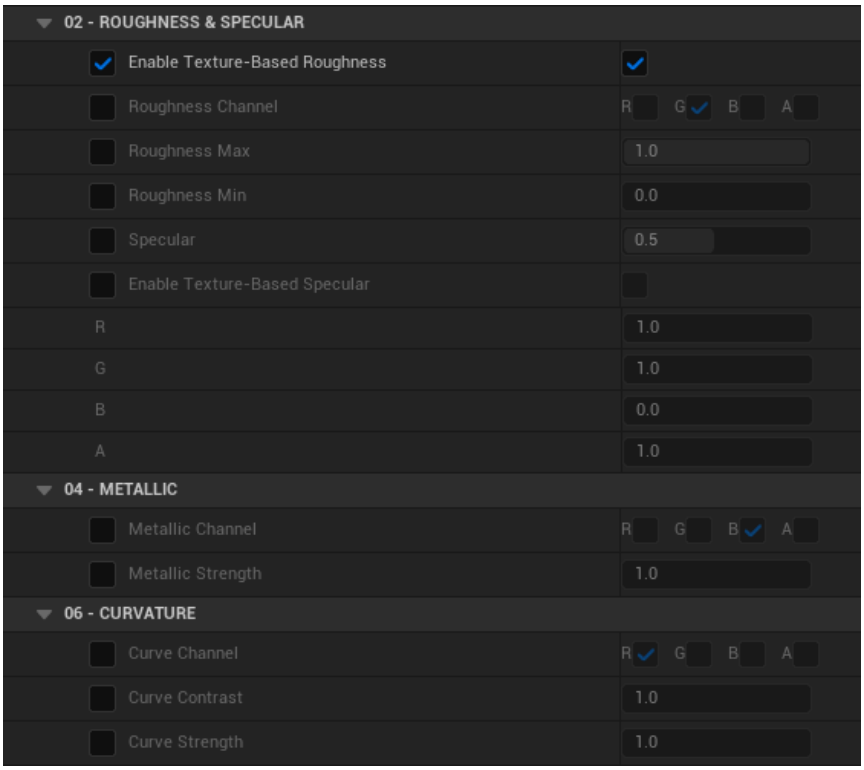
Normal Section



The normal section contains settings to change normal strength (RGB = XYZ). You will usually ALWAYS leave B/Z as 1 and change R and G to modify strength. A second normal is available here for most material templates that can function as a detail normal, hero normal (where the base normal is a trim normal for example) or a macro normal.

Note: When using World-Aligned/Triplanar UVs the Tiling setting will function as SCALE and will need values in R, G and B (not just R and G for UVs). I almost always start with 512, 512, 512 values when using World-Aligned UVs/Triplanar in any sub-feature of our material system. Since triplanar-based projection blends between XY, XZ, YZ planes, you will need to tweak the Contrast setting that appears to make sure the planes blend to your liking.

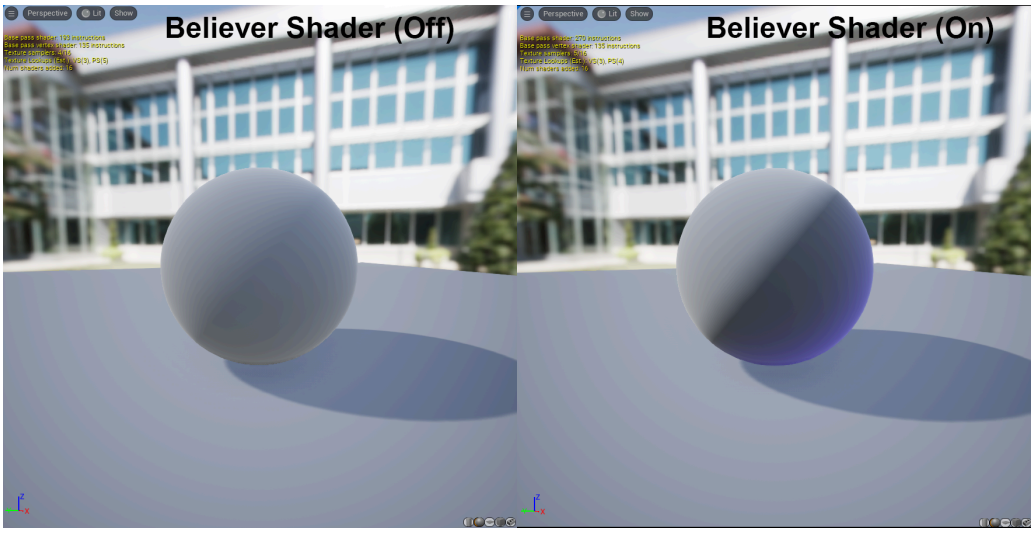
PBR Sections - Roughness, Metallic, Spec, Curvature



The PBR sections allows you to make tweaks to your RGB pack from Substance without having to re-export the texture. This lets you change things like the Roughness min-max, Specular, Metallic and Curvature strength and contrast. Note: Curvature isn't used by default in a simple template and is fed to other layers/features (such as Grunge) to control/mask different aspects.

Full Workflow (Part 3): Working with the Believer Shader

The Believer Shader is our custom material layer that is split into two distinct features: The Believer Shader (Per-asset material-based cel shading) and Believer Rim Light (a material-driven rim light). Most aspects of both features are controllable on a per-asset AND global basis (things like the rim light color are controlled by a global setting but can be overridden locally for ultimate control).



Configuring the Believer Shader (video)

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/d0911a29-5a2f-48e6-add1-1daabe73a574/mat_believershader.mp4

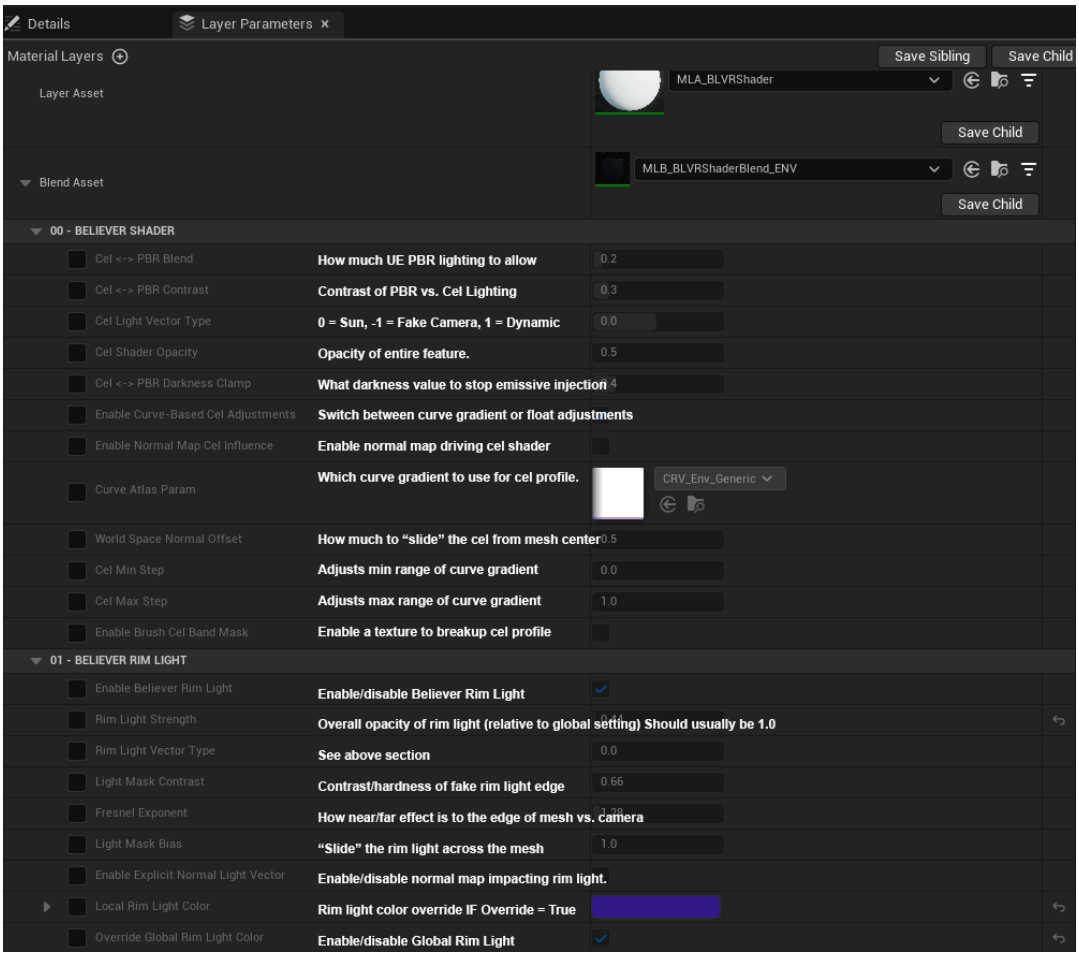
Configuring the Believer Rim Light (video)

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/d479364e-a7e0-43d0-9cc6-b6ab19535cb8/mat_believerrimlight.mp4

Creating a Custom Curve Gradient (video)

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/fb2c4c72-2183-4e29-98d3-87ad8b4f0b71/mat_customcurvegrad.mp4

All of the Believer Shader settings actually occur in the Blend Asset, as opposed to the Layer Asset section. The reason for this, is the math required for the Believer Shader to work relies on reading from many individual channels of the bottom layer and making manipulations to multiple PBR channels that cannot be done with straight alpha math.



Full Workflow (Part 4): Working with our custom layers

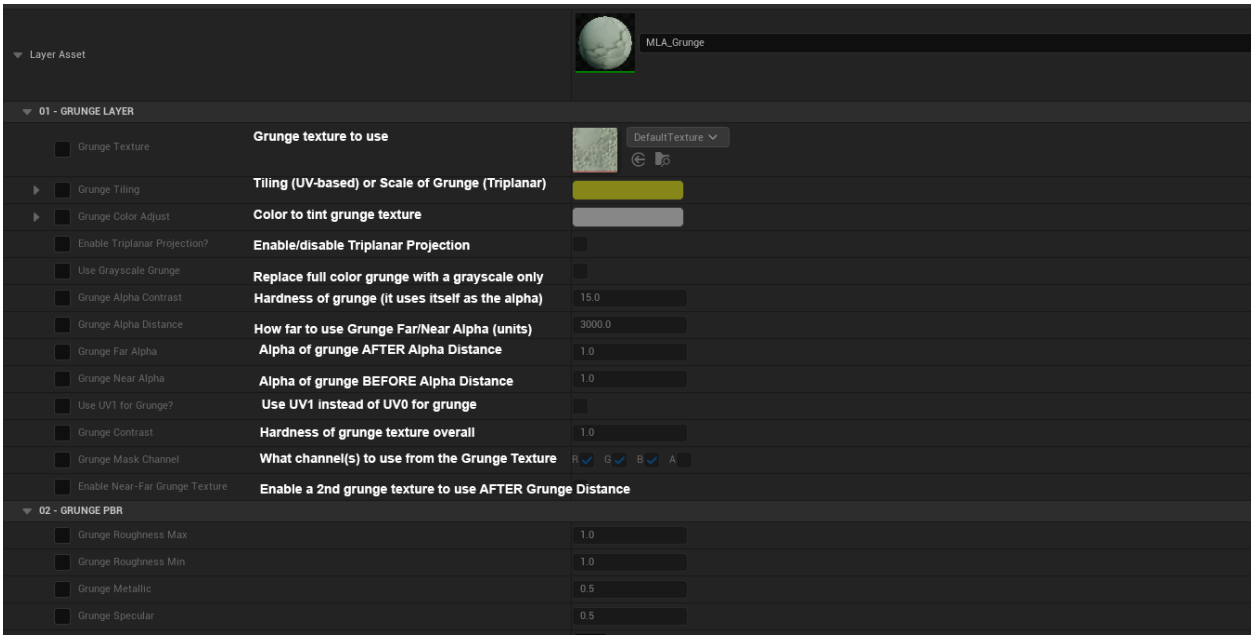
We have a library of fully featured Material Layers in situations where multiple PBR channels are needed to sell the feature. This includes things like Grunge, World Up, Ground Blending. Every Material Template has its own set of default layers (turned off by default in case its not actually needed). For example, if you want to use Grunge in one Trim sheet, but not the other, simply use the visibility (eye ball icon) button to enable/disable that layer.

Grunge (MLA_Grunge)

The Grunge layer is found in: All environment Material Templates

Our grunge layer is designed to blend a texture that influences both base color, roughness, metallic & specular on top of the background layer with different alpha values, or even a texture swap, based on different distances to cover style-specific use cases like: Bold brush strokes at distance, but more subtle up close.

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/0d8387fc-b825-4960-8db3-346907219b6d/mat_grunge.mp4

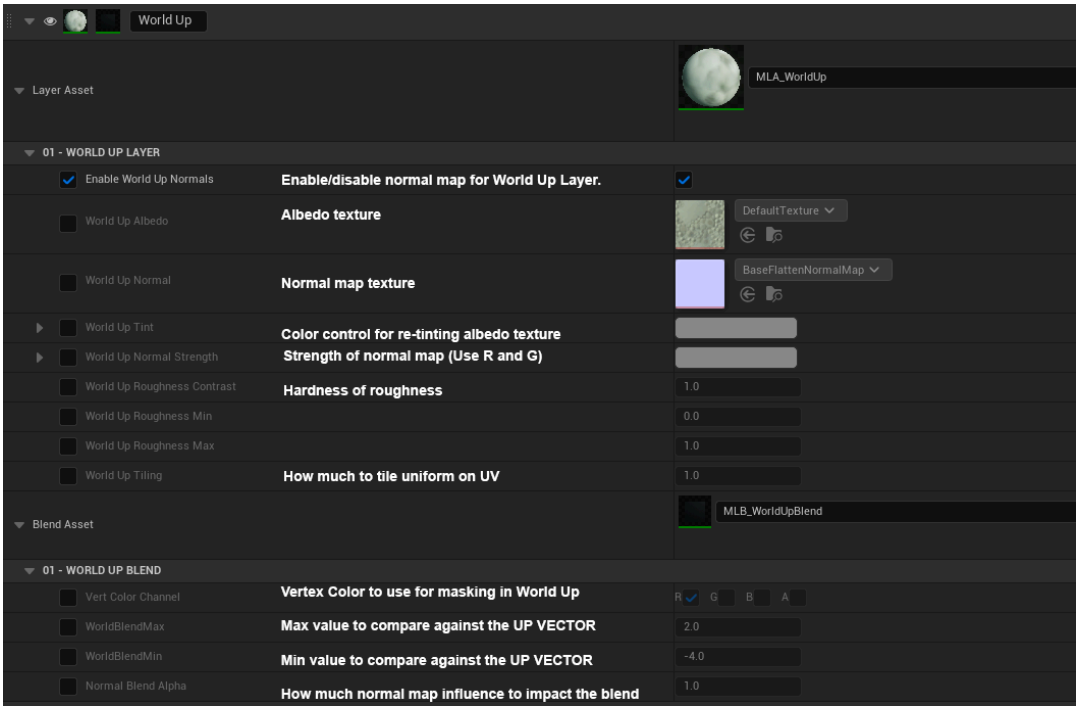


World Up (MLA_WorldUp)

The World Up layer is found in: MT_ENV_Hero, MT_ENV_Trims, MT_Env_CliffRocks

Our World Up layer is a custom layer designed to blend onto the “top surfaces” of meshes procedurally for use cases where we may want moss/snow/dirt to accumulate on the top surfaces of geometry without manually painting it.

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/6e45eb91-a95e-4e80-9d93-44fa23c67cb4/mat_worldup.mp4



Ground Blending (MLA_GroundSkirt)

The Ground Blend layer is found in: MT_ENV_Hero, MT_Env_CliffRocks and features multiple setups starting with very simple ones like Vertex Color painting a “skirt” with a texture assignment all the way up to distance field-based intersection detection with a virtual texture to project the underlying textures onto the surface w/ normal correction.

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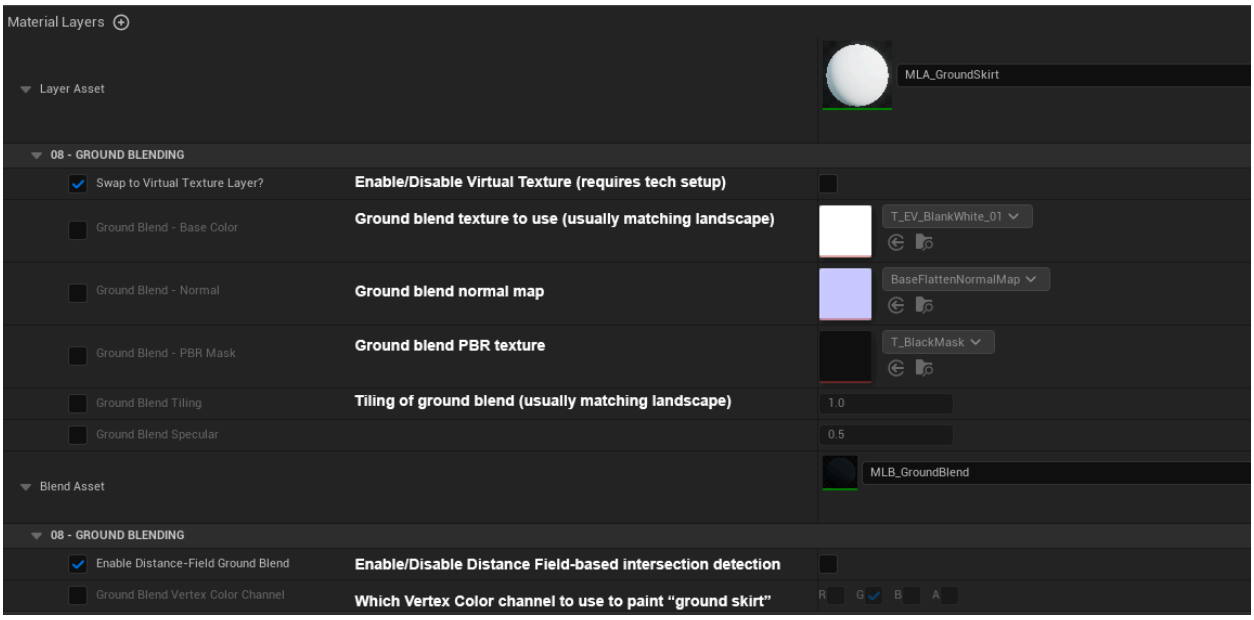
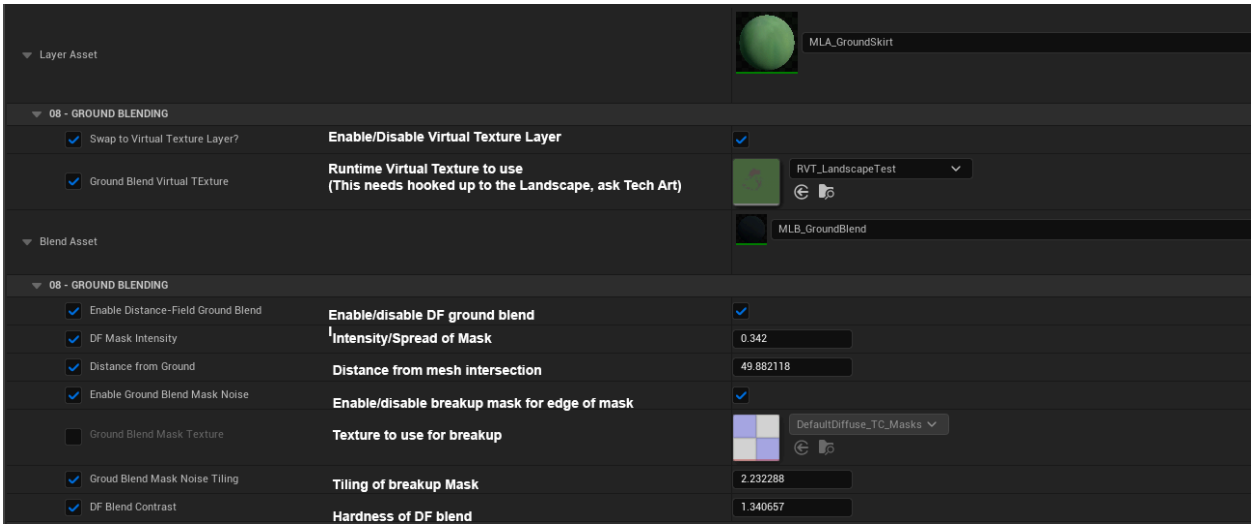
Vertex Color Setup (Cheapest)



Distance-Field + Virtual Texture Setup (Most Expensive)



Note: This feature may not function on lower end platforms and may disable the feature entirely but it will still work on higher platforms.

Full Workflow (Part 5): Working with our custom Material Templates

Our material template library contains preconfigured default settings for the Background layer and a preconfigured list of Material Layers (disabled by default) that you can toggle on/off per-asset for your creative needs. In addition to this, each Background layer may feature its own feature set that differs from template-to-template. Those features are covered in the below sections.

Our Material Template library as of July 15, 2024

Note: Our material template library will grow overtime and may contain children templates that add/change base configurations to make things easier. Example: MT_ENV_Foliage will eventually have multiples like MT_ENV_Foliage_Trunk, MT_ENV_Foliage_Grass, that will mostly be MT_ENV_Foliage but with a few overrides changed, such as the Blend mode/shading model.

Character Material Template (MT_CHA)

This template is the starting point for all character material instances.

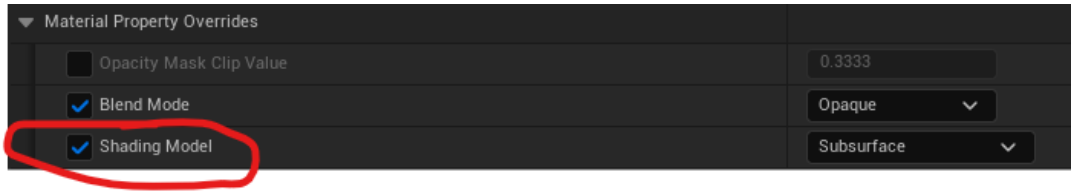
Default Layers: Background (MLA_CHA), Believer Shader

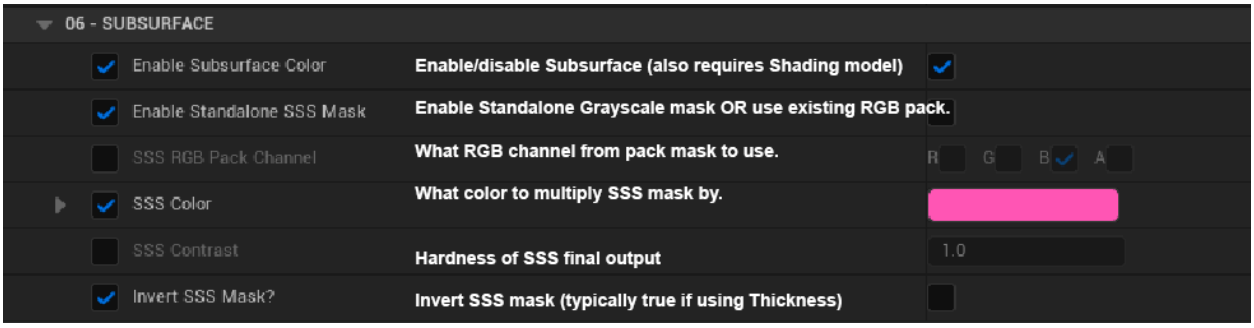
Children Templates: None

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/1b6820b1-a62e-4bde-ad52-f9fe95f7d075/mat_mt_cha.mp4

Subsurface

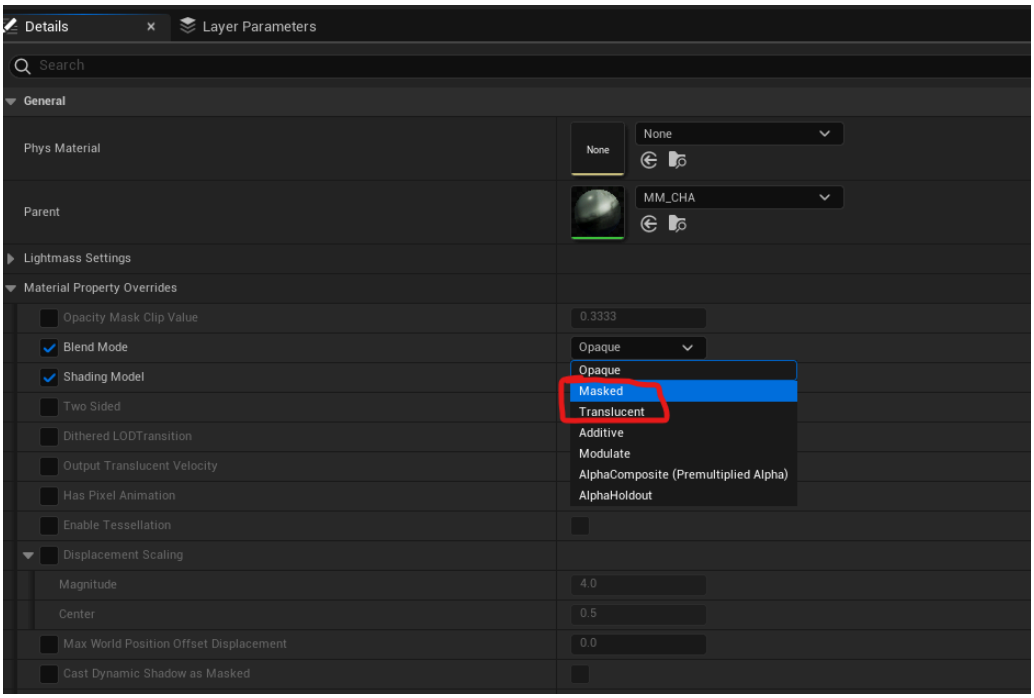
This section is designed for skin/subsurface scattering and our standard is to use a Thickness bake from substance to invert in the material to apply SSS. **This requires the Shading Model to be Subsurface Color or Preintegrated Skin. It will not work if its default.**

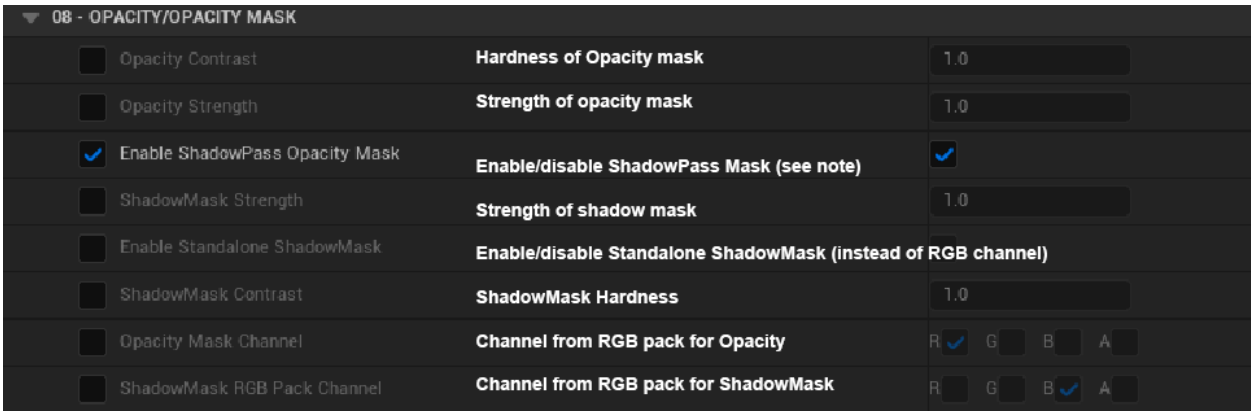




Opacity/Opacity Mask

This section is for character sections that need masking or translucency. **This requires the Shading Model to be Masked or Translucent. It will not work by default.**





Note: ShadowMask is a feature to allow blending of a texture into the mask to change the shadow appearance. It is heavily bound by shadow resolutions so it may not look as crisp as intended (say you're trying to make the shadow have brush strokes, it may not have enough resolution to sell the feature). This feature was left in the shader in case it improves down the road.

Character Fresnel

This feature allows for a fresnel-based "edge glow" that can help characters pop against the environment. This is a separate feature from all aspects of the Believer Shader.

Environment (Simple) Template (MT_ENV_Simple)

This template is the starting point for environment assets that do not need robust material features that can lean more on textures and the Believer Shader.

Default Layers: Background (MLA_ENV_Simple), Grunge (Off by default), Believer Shader

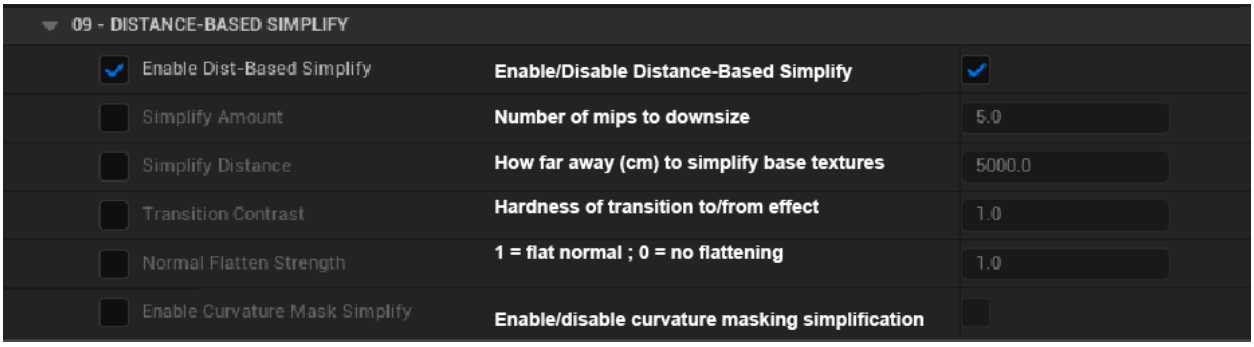
Recommended Use Cases: Tileable materials, props, simple assets, far away vista assets

Children Templates: None

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/065035c1-1789-4b75-8a98-067a58bfdff2/mat_mt_Env_simple.mp4

Distance-based simplify

This feature forces all the base textures to a lower (blurrier) mip value based on an artist-configured distance to give flatter color reads sooner for style.



Note: This feature exists in ALL environment templates.

Environment (Trims) Template (MT_ENV_Trims)

This template is the starting point for trim sheets.

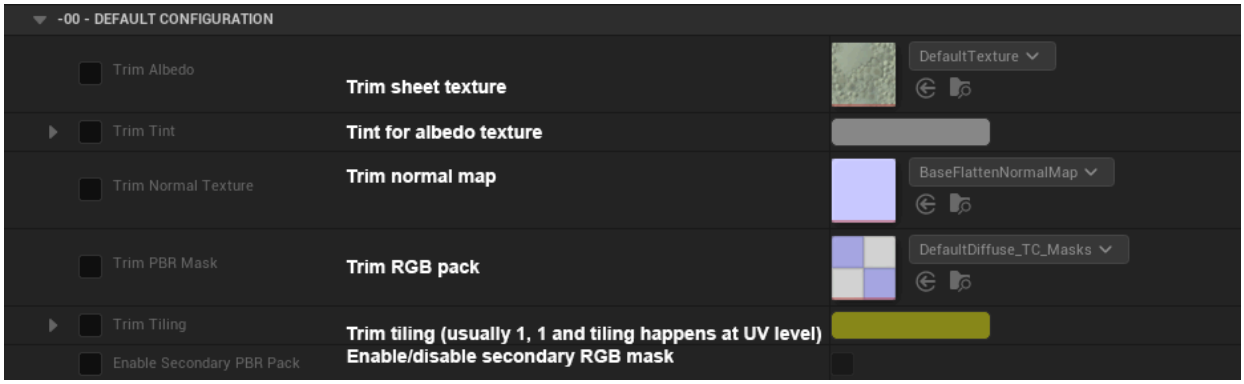
Default Layers: Background (MLA_ENV_Trims), World Up (Off by default), Grunge (Off by default), Believer Shader

Recommended Use Cases: Trim sheets, assets that need two texture sets

Children Templates: None

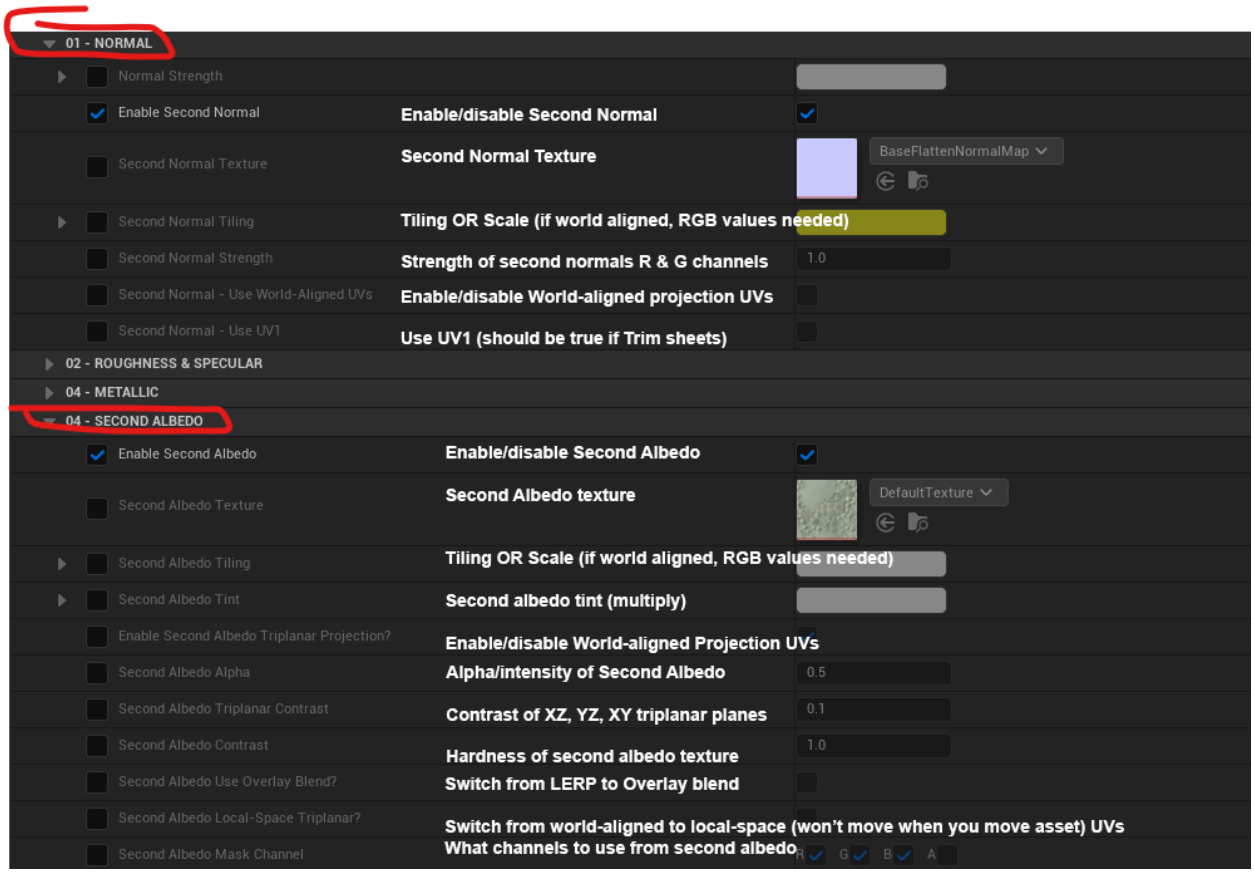
https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/c90da853-7139-4bdd-b4e3-df5bb6fe06a5/mat_mt_env_trims.mp4

Our standard setup for Trims involves using your trim sheet (albedo, PBR mask and normal) as the base texture set. You then combine Second Normal, Second Albedo, Tricolor FEATURES and/or Grunge layers to add surface detail. This is because Unreal calculates tangents for Tangent Space Normals based off of UV0/the default normal map, and UVing to trim sheets with flipped shells can remain 1:1 with DCCs.



Second Albedo & Second Normal

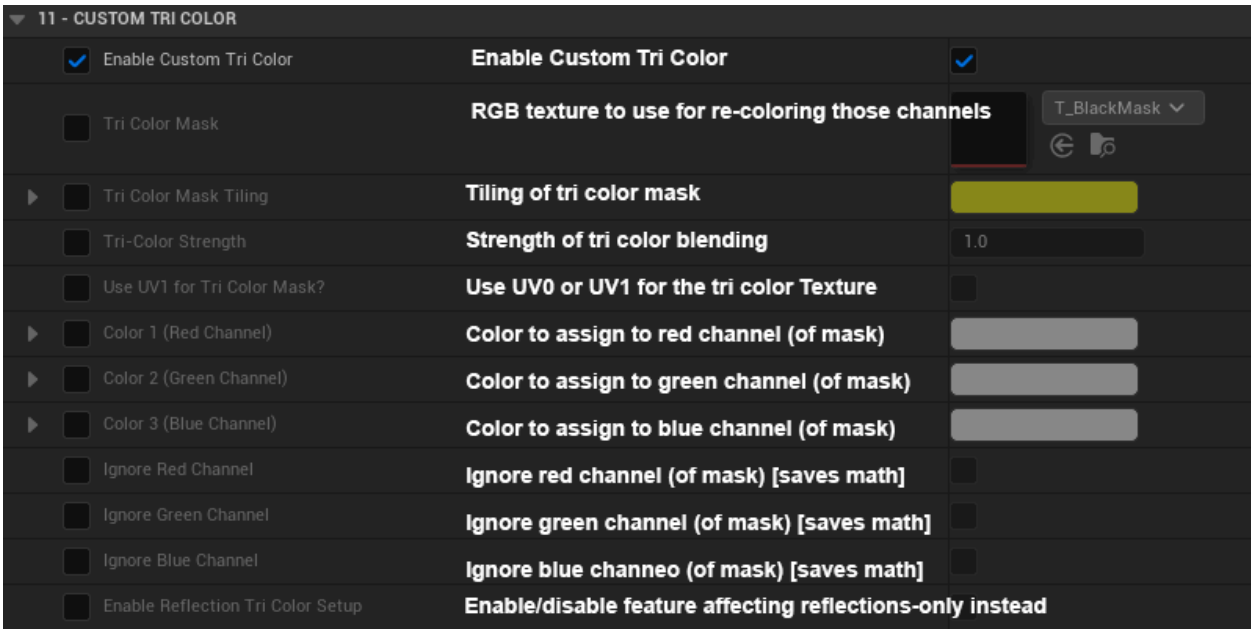
The combination of these two features allows trim sheets to layer in additional surface detail (macro or micro) based on the other settings used. The settings can match or be different between Normal/Albedo. For trim use, if you have unique UVs you'll want them to be on UV1 and then set Use UV1 to TRUE for the two features below to assign the unique secondary textures.



Note: Second Normal is a feature of many of the other material templates. Second Albedo is also part of the Cliff & Rocks template.

Custom Tri Color

This feature enables the ability to use a RGB mask to assign new colors to each channel for fast re-colors of different trim sheets.



Environment (Foliage) Template (MT_ENV_Foliage)

This template is the starting point for foliage, grass, trees, etc.

Default Layers: Background (MLA_ENV_Foliage), Grunge (Off by default), Believer Shader

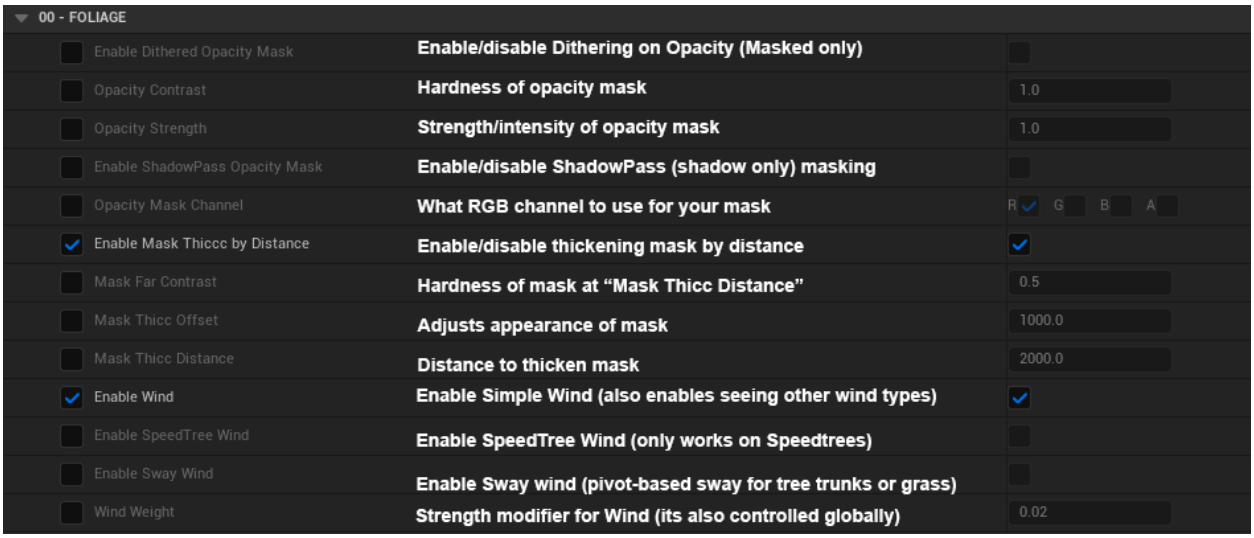
Recommended Use Cases: Foliage, grass, trees, etc.

Children Templates: MT_ENV_Foliage_Trunk, MT_ENV_Foliage_Grass, more coming soon

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/f1b87fdf-9ba3-42fe-a4f1-d612ee99db80/mat_mt_env_fol.mp4

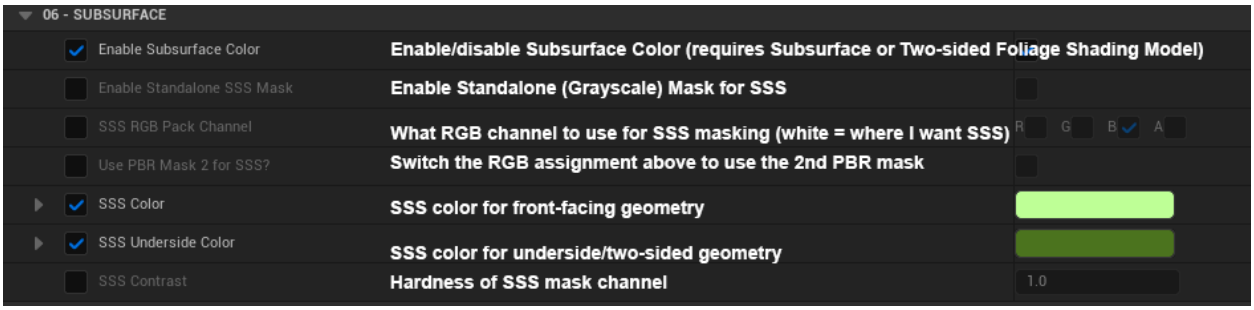
Foliage Settings

This section covers many of the common features shared for most foliage materials: opacity (masked/translucency), mask adjustments, & wind.



Subsurface

This section is a foliage-specific implementation of Subsurface. You will want to make sure Two-sided = True and the Shading Model is ***Two-Sided Foliage or Subsurface*** for this section to function properly.



Environment (Cloth) Template (MT_ENV_Cloth)

This template is the starting point for cloth, banners, assets that may need wind/motion but are not foliage.

Default Layers: Background (MLA_ENV_Cloth), Grunge (Off by default), Believer Shader

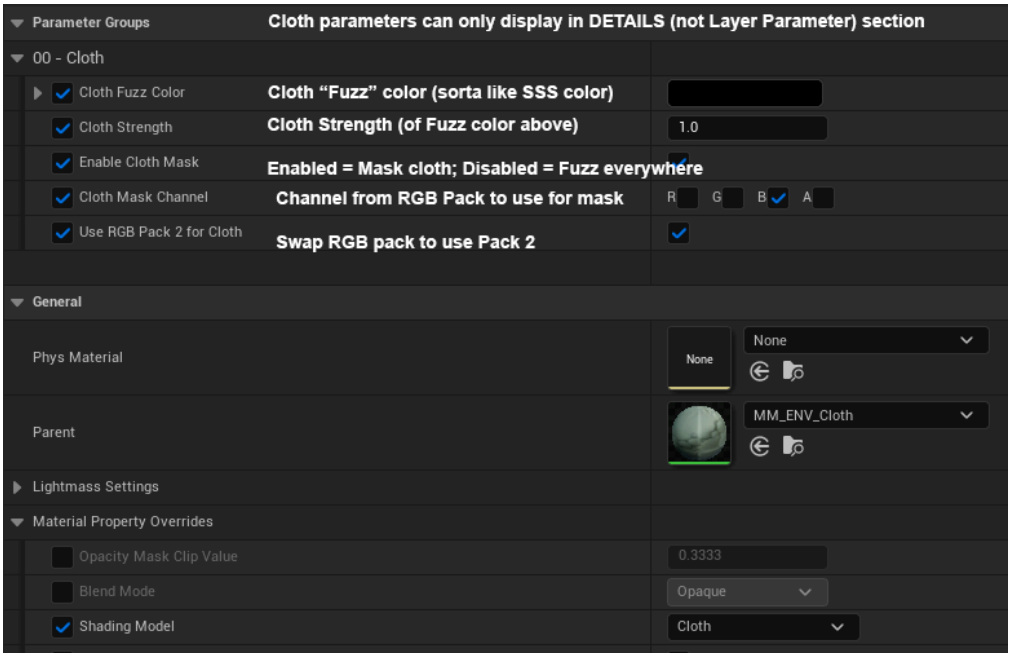
Recommended Use Cases: Banners, flags, drapery, etc.

Children Templates: MT_ENV_Cloth_Masked

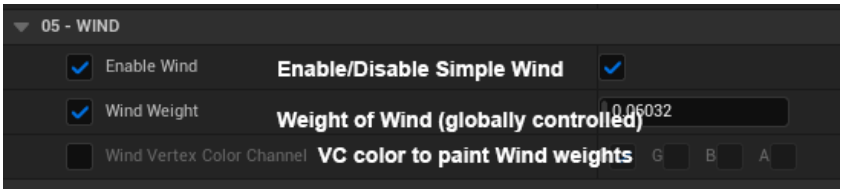
https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/2e55de4a-fff4-4489-928d-9e8b2606ed6a/mat_mt_env_Cloth.mp4

Cloth Settings

The Cloth shading model in Unreal (as of 5.4.2) is locked to the normal Material channel stack, meaning that the parameters to control Cloth can only be hooked up outside of Layer Parameters. For Cloth settings they are shown in the **Details panel.** All other parameters custom to our system will be in **Layer Parameters** like every other Material Template.

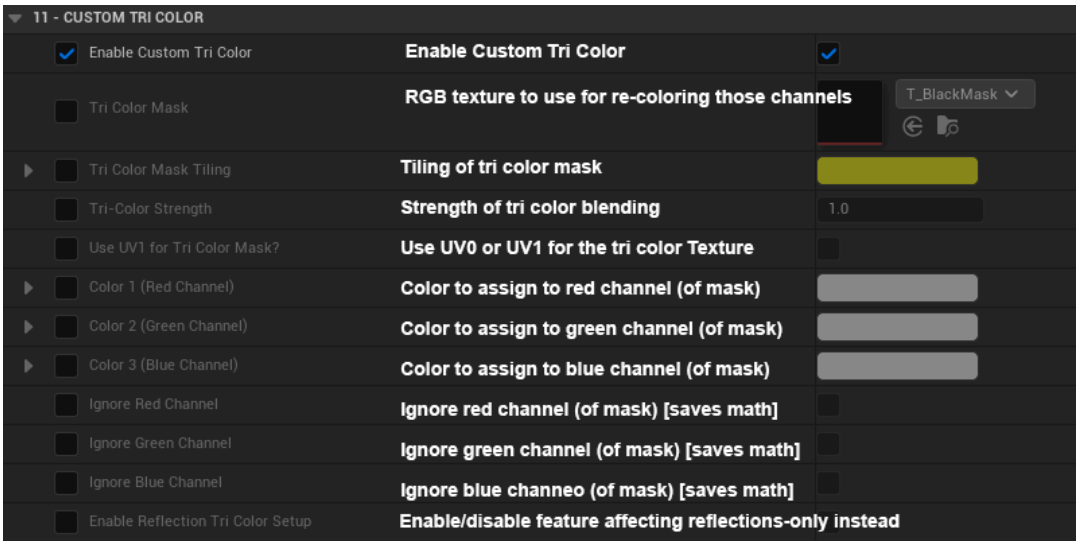


Wind



Custom Tri Color

This feature enables the ability to use a RGB mask to assign new colors to each channel for fast re-colors of different cloth designs.



Environment (Cliff & Rocks) Template (MT_ENV_CliffRocks)

This template is the starting point for cliffs, rocks and other geological assets.

Default Layers: Background (MLA_ENV_CliffRocks), World Up (Off by default), Grunge (Off by default), Ground Blending (Off by default), Believer Shader

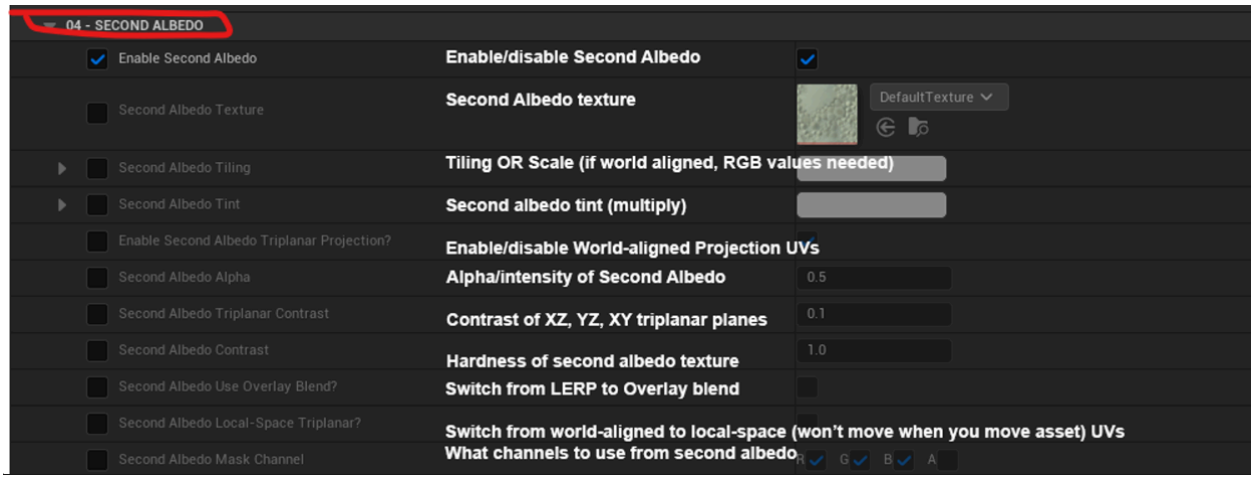
Recommended Use Cases: Cliffs, rocks, overhangs, any geological type assets.

Children Templates: None

[video]

Second Albedo

In the context of cliffs/rocks this second albedo is designed to be used for things like cliff striations or other detail that may need to be tiled in one direction or triplanar projected.



Environment (Glass) Template (MT_ENV_Glass)

This template is the starting point for glass.

Default Layers: Background (MLA_ENV_CliffRocks), Grunge (Off by default), Believer Shader

Recommended Use Cases: Glass, windows

Children Templates: None

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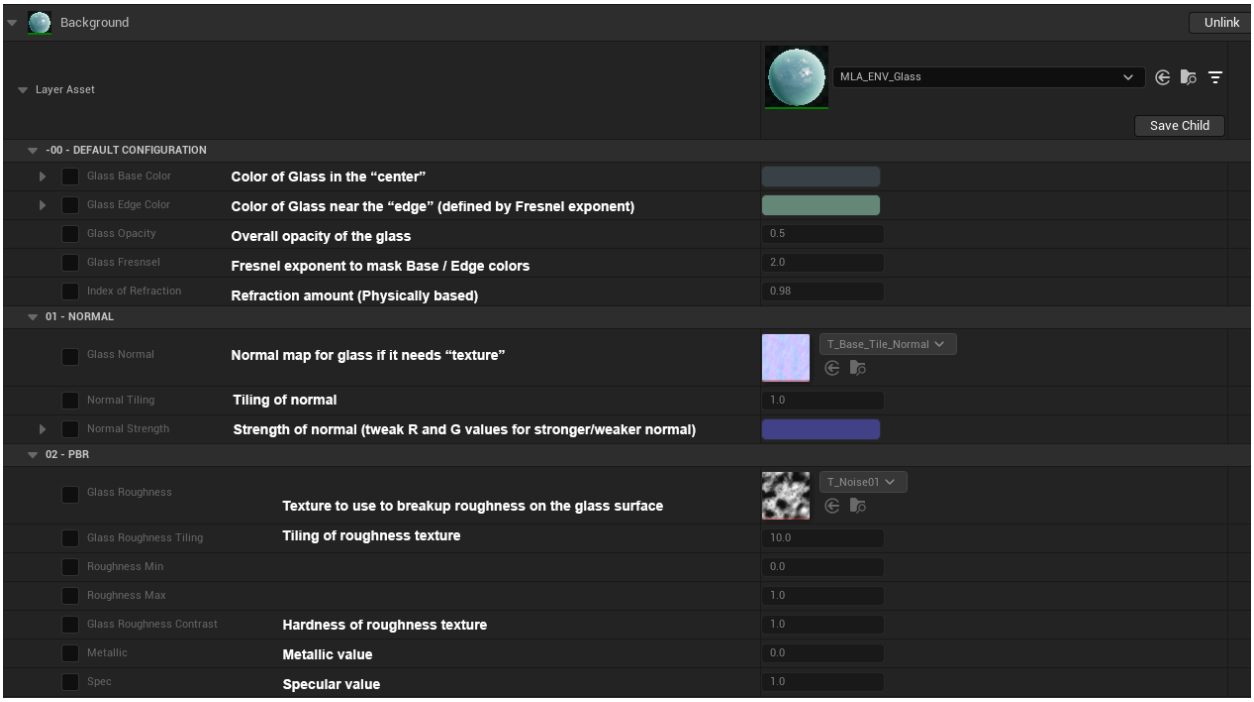
Glass Setup



Environment (Hero) Template (MT_ENV_Hero)

This template should only be used if NO other material template covers the needs of your asset. It contains every material feature and layer available, and thus is intensely expensive.

Default Layers: Background (MLA_ENV_Hero), All of them

Recommended Use Cases: Hero assets that aren't covered by another template

Children Templates: None

No video or breakdowns will be created for this because it includes ALL features/layers of all other areas of this doc, watch all the other sections to cover the hero material.

Environment (Landscape) Template (MT_ENV_Landscape)

This template is a specialty master material template that does NOT use the layer parameters system (mostly because Landscapes in Unreal have their own paradigm for painting layers). This is our fully-featured material for Landscapes.

Default Layers: None, this material instance is configured entirely in the ***Details*** panel.

Recommended Use Cases: Unreal landscape only

Children Templates: None

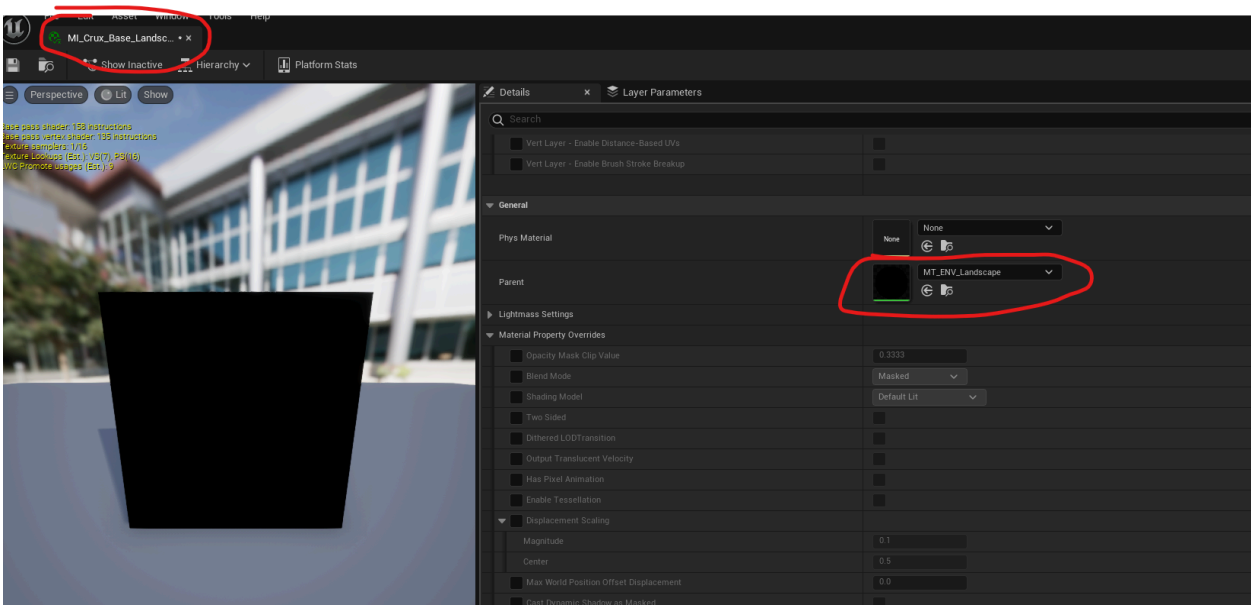
Layer Configuration:

1. Our landscape is made up for FOUR standard paint layers:
    a. Base (intended for biggest coverage, like grass)
    b. Vertical (meant for vertical surfaces)
    c. Breakup (meant for paths or path edges under splines)
    d. Shared (designed to be a layer that exists in ALL sub-biomes to paint over landscape transition seams)
2. Because of platform texture restrictions, Unreal landscapes are typically restricted to 3-4 paint layers per component. However, you can make new MI's to swap out textures on a per-component basis.

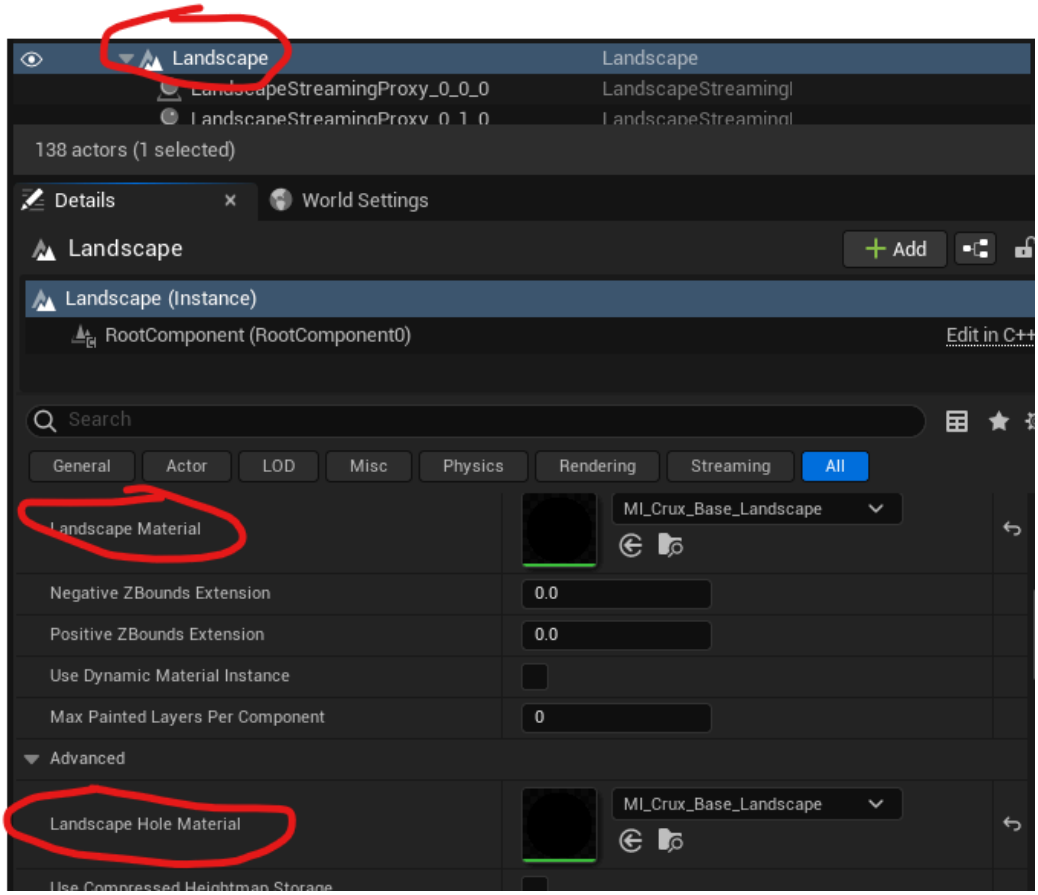
Setting up a Landscape Material

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/28886953-d4d1-4be4-99f3-ac03f7af400c/landscape_mat_setup.mp4

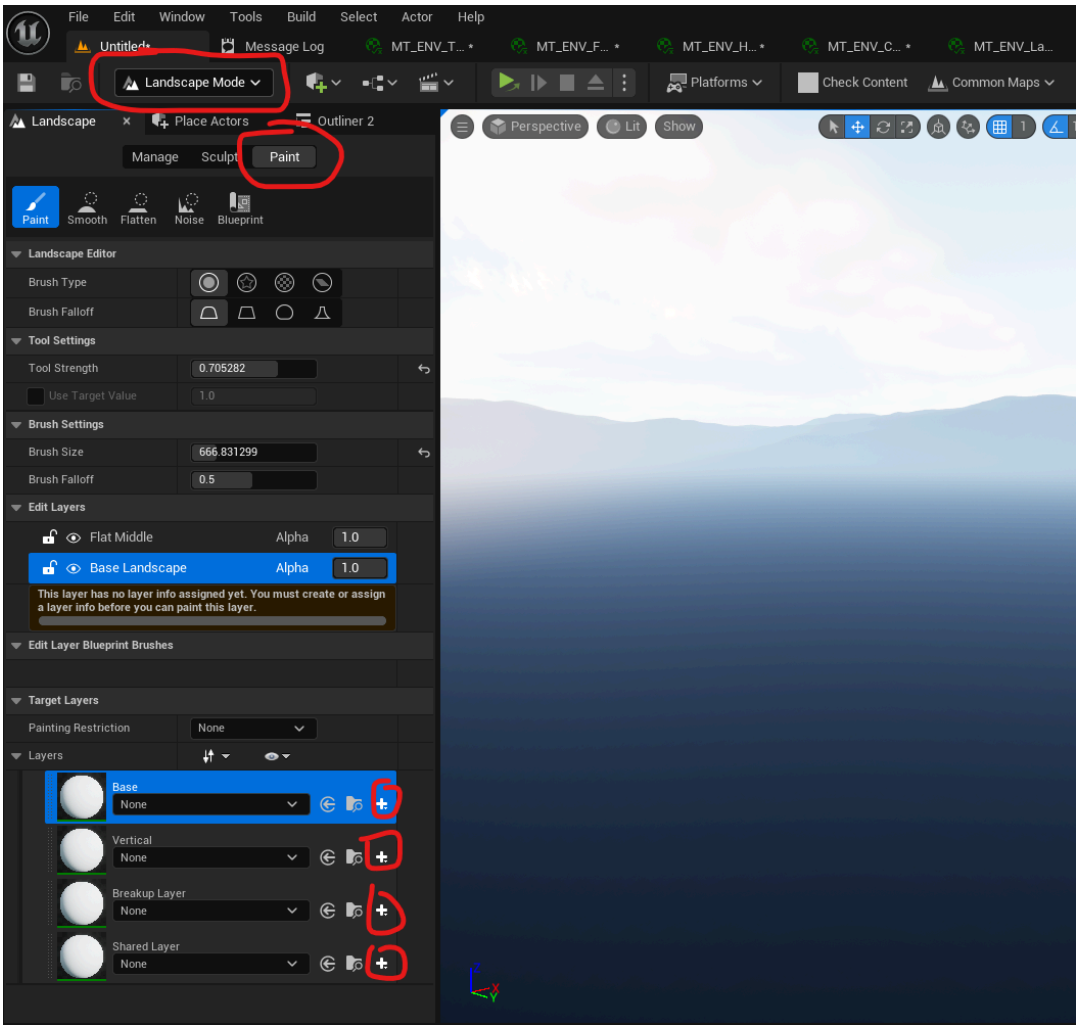
1. Create a material instance of MT_ENV_Landscape named after the planet/subbiome and move it to the appropriate folder, or create it there and assign MT_ENV_Landscape as the Parent.



2. In the world outliner, select your landscape and assign your new material to ***Landscape Material & Landscape Hole Material:***



3. In the top left of Unreal where it likely says ***Selection Mode*** click that dropdown and go into Landscape Mode → Paint Tab

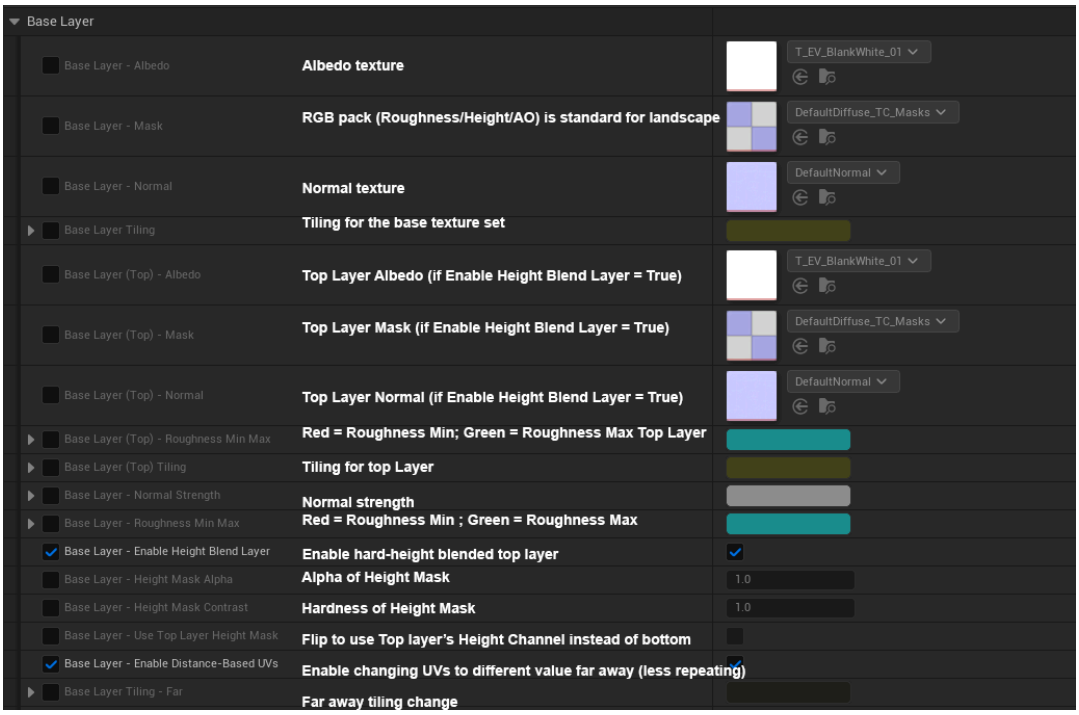


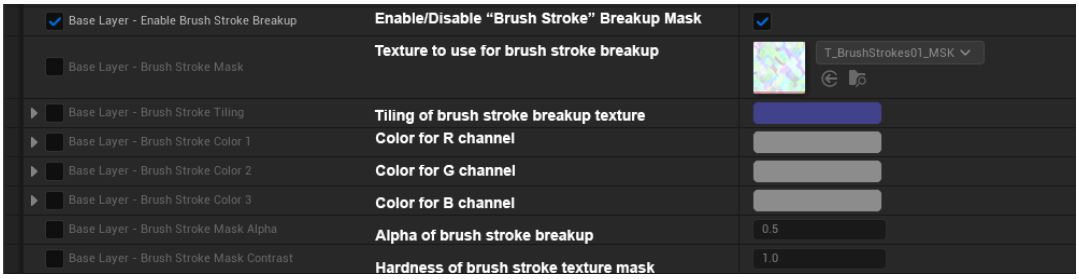
4. As shown above, you should see Base, Vertical, Breakup Layer, Shared Layer in the Layers section. You now need to create LayerInfo assets for each one. Click the + icon and choose **Weight-Blended (normal).** The default folder within the map (Mapname_Sharedassets) is fine. LayerInfos should always be unique per landscape/planet. EX. LI_Crux_BaseLayer
5. After assigning layer infos, your landscape should no longer be black, and you can start tweaking the material instance settings and painting.

Overview of Landscape Master Material

https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/e3fd1604-4d00-48db-b9ca-005a3fc97a94/landscape_mat_overview.mp4

All 4 layers are made up of the same parameters and texture options and can be mixed/matched to artistic vision.





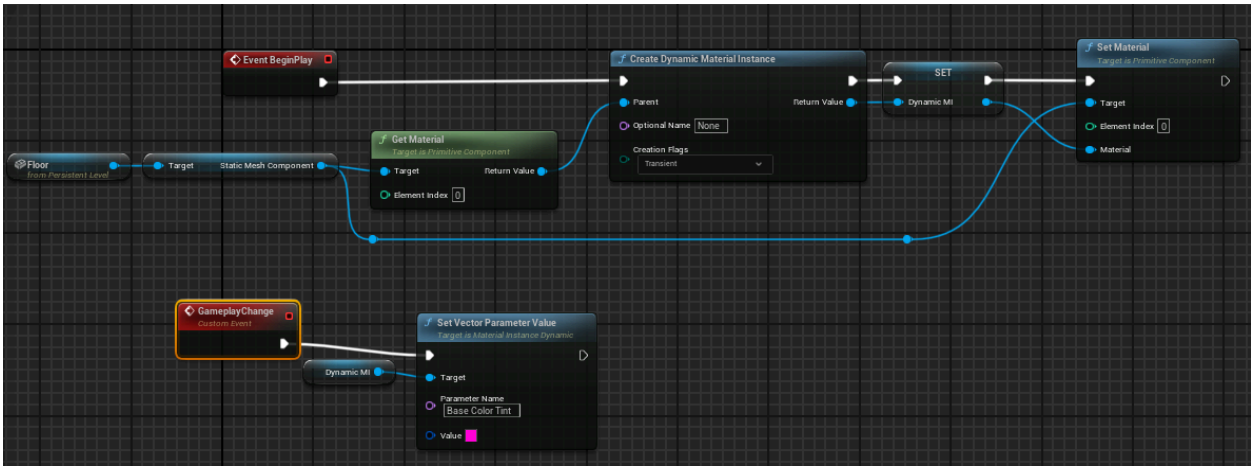
Appendix

Advanced Use Cases/Features

Creating Dynamic Materials in Blueprint or Code

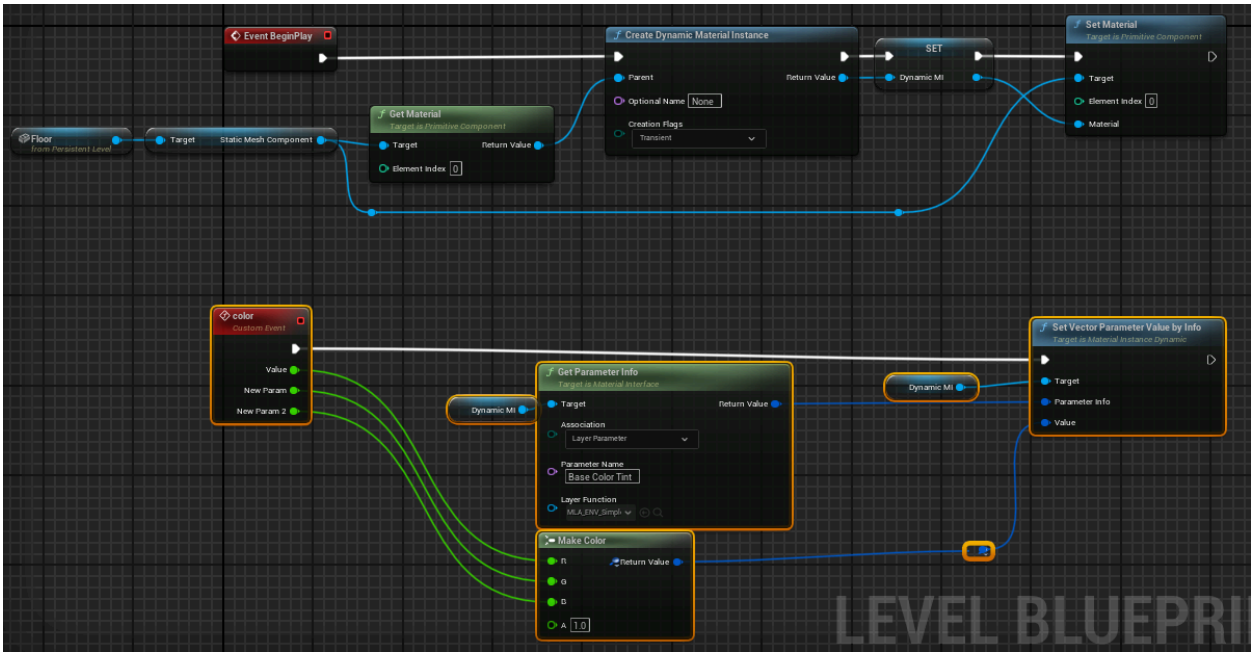
https://prod-files-secure.s3.us-west-2.amazonaws.com/792ae76d-8ed4-4636-9eae-59a35de85eb4/bc3d4e52-d2fc-4178-a644-722124447b89/creatingdynamicMIwLayers.mp4

Dynamic materials are typically used by creating a dynamic material, applying it to a mesh and then setting parameters by name. (See below)

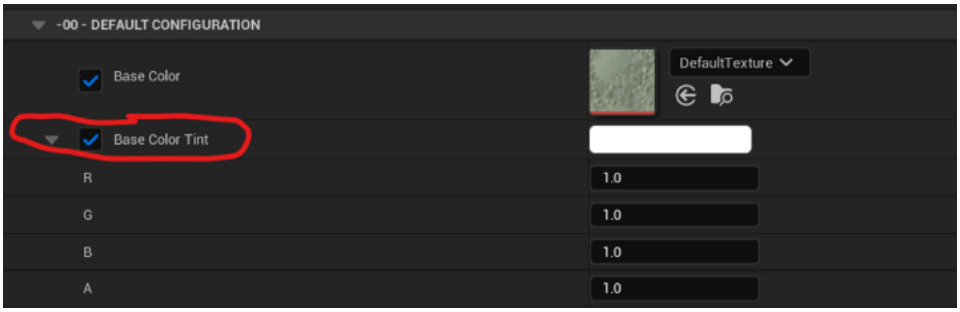


This method does NOT work for our material workflow anymore UNLESS it does not use layers. UI, VFX & Landscape materials will likely NOT use layers, so the classic method above is still ok.

New Method

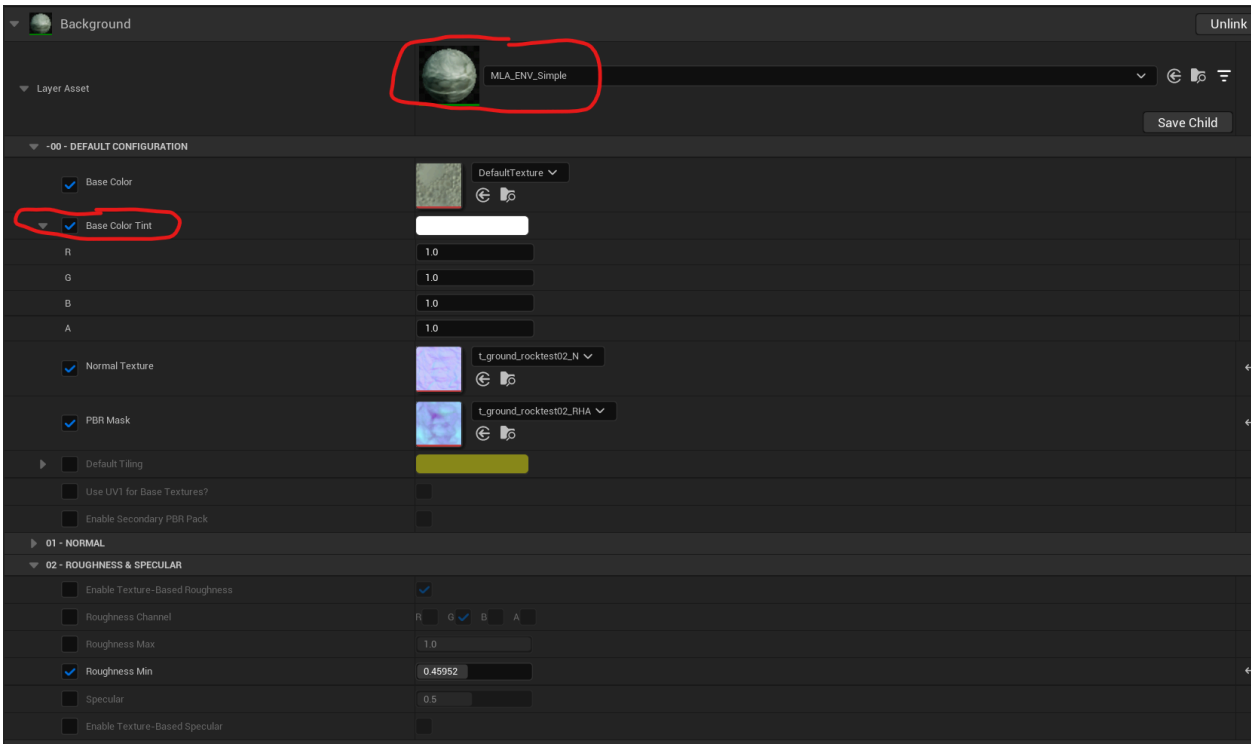


The parameter you want to change at runtime HAS to have the checkbox on the left checked to allow Overrides:

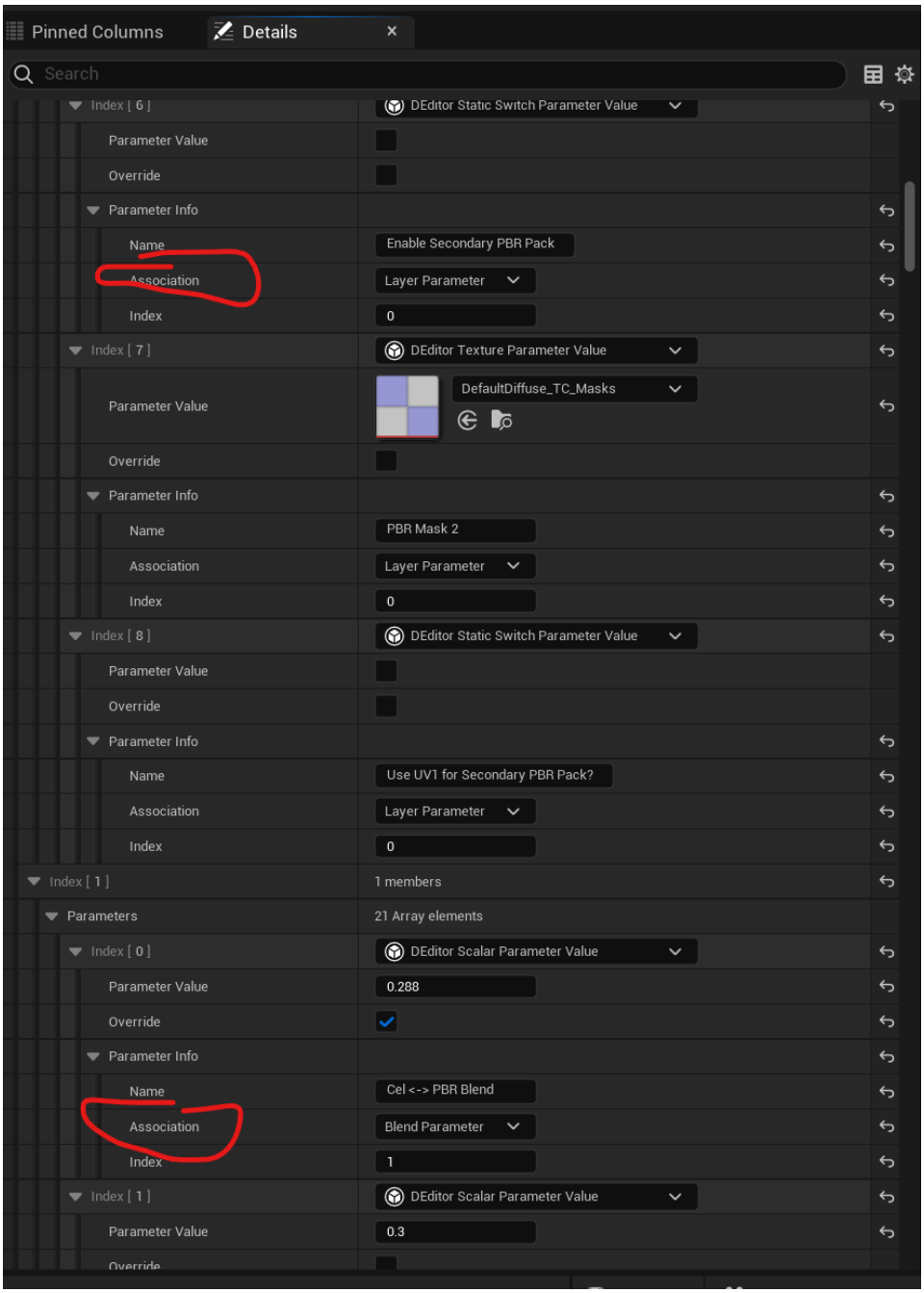


Finding the Layer Function & Association Setting

1. Open the material instance assigned to the mesh.
2. Go to the Layer Parameters tab.
    a. IF there are NO layers in this tab, use the classic method.
    b. Find the Layer Asset that contains the parameter you want to change at runtime. That is the layer asset you will reference in GetParameterInfo.
    c. Note the Parameter name you want to change.



3. For normal parameters the Association ENUM value will almost always be **Layer Parameter** but you can double check this by opening the Property Matrix inside the Material Instance and checking the parameter info in the Details panel.



You can also deduce the Association by seeing if the parameter is part of the Layer Asset or Blend Asset.

Mesh Painting Workflow