# World Builder for AGK

User Guide

V0.828

# Contents

# Introduction

The World Builder is a featured scene creation and placement editor tool for AGK which allows users to create complex and professional 3D worlds quickly and easily through a simple intuitive interface. This guide explains the features within the editor and explains how to use them to best effect.

The World Builder was originally started to facilitate the creation of a game project, however when dealing with 3D it can be difficult to prototype or build 3D worlds without an editor. This tool was designed to facilitate this for private use, however as the tool expanded and gained more functionality it became a development in its own right. Many of the functions currently included have evolved from the need of hands on use, with later features requested by ALPHA testers. Many more functions are planned, however currently the World Builder can:

- Easily build complex landscapes
- Apply multiple textures to the landscape
- Features a full ocean, sky and day / night simulation
- Allows placement and control over thousands of in world objects easily
- Allows an easy interface to create and place complex particles using AGK functions
- Allows an easy interface to create and place lights using AGK functions
- Create automatic coastlines, including functional waves. This coastline feature also creates an audio map to play ocean sound effects at a volume based on distance from the shore
- Easily generate complex grass over the world using a simple painting interface
- Define AI characters, and set paths around the world that they will follow
- Test the world at anytime with a basic 1st or 3rd person game mode
- Apply complex normal mapping and specular mapping with zero coding knowledge using built in shaders
- Apply real time reflections to the ocean

All these features will automatically be usable in your own programs through an export option and source code supplied to load and power your world.

# The basic world construction

## Technical makeup

The worlds created in the editor are designed around the principle of being self-contained chunks, or sections of the world which are put together. The default layout for a world is 8 chunks wide by 8 chunks deep, giving a standard layout of 64 usable chunks. Each of these chunks is built up of a mesh which is 256 * 256 vertex points, making each 65,536 vertex points in size. This gives the world landscape 4,194,304 vertex points for the user to build a world from.

## Texturing

Each of these chunks is independent to the others and therefor can have unique textures applied across them. The default shader which comes with the World Builder allows for an array of customer textures to be applied to the landscape, in the following rendering order:

- Up to 8 base textures, rendered in order of hierarchy
- A single grass texture, which appears under generated grass decals
- Up to 3 path layers

These textures are set within the editor, and draw based on an order of priority. This means that a landscape texture set in slot 1 will always be drawn under any texture set in slot 2, which in turn will always be drawn under any texture set in slot 3, and so on.

Where grass is generated with the builder a separate texture can be specified to draw underneath this, which will appear on top of all landscape base textures.

Lastly, the editor supports up to 3 path layers which follow the same hierarchical drawing order for each other as the base landscape textures, but will always appear on top of any grass. Where paths are drawn grass will no generate on top of it, however the grass must be generated after the paths are drawing for the masking to take effect.

# Interface basics

The basic interface for the editor looks like figure 1 below when starting a new world. Upon loading no textures will be set to the ground will display “NO IMAGE”, and the camera will be positioned roughly in the centre of the world.

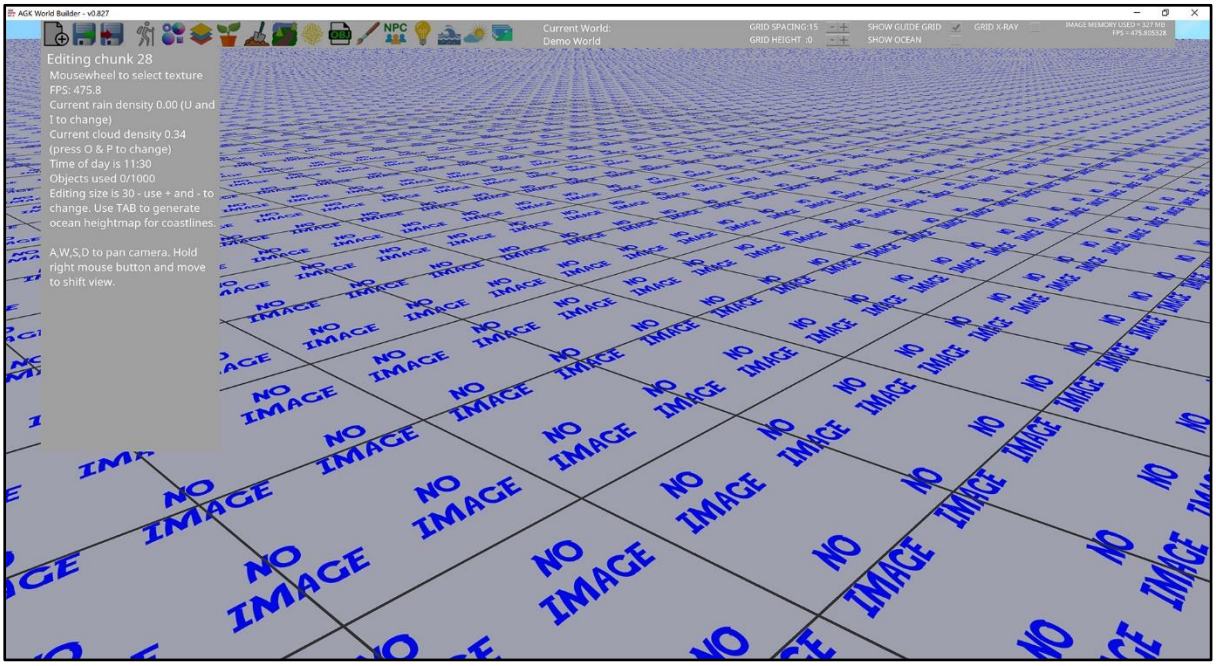



*Figure 1*

## Camera movement

Movement of the camera is accomplished with a combination of mouse and keyboard controls. Holding down the **right mouse button** and moving the mouse will pan the camera left, right, up and down. To move the camera use the W, S, A, D keys on the keyboard. W will move directly forward in the direction facing, while S will move backwards. A and D will slide the camera left or right respectively.

If the **shift key** is held down while using the movement controls the camera speed will be substantially increased to cover larger distances more rapidly.

## Chunk info panel

At the left hand side of the screen a general information panel, similar to that in figure 2, will show the basic information for the chunk the camera is currently over. This is called the **active chunk** through the rest of this guide.

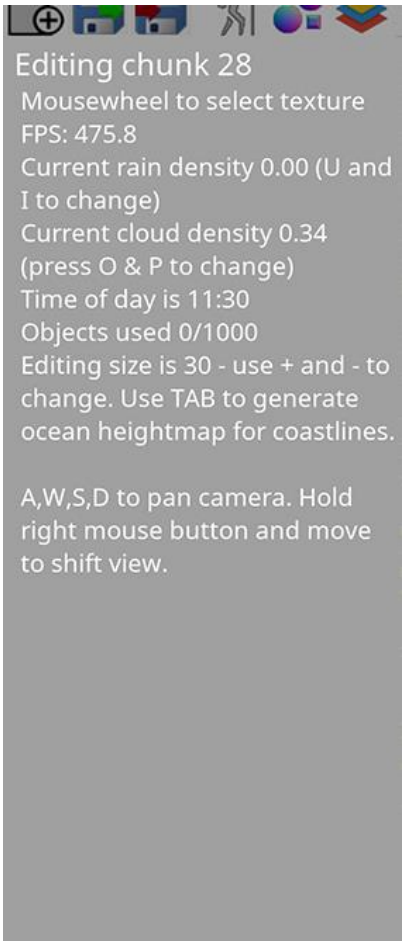



*Figure 2*

At the top the current active chunk is shown, in the range of 1-64, which will change and update as the camera is moved.

Some additional information is shown here, which the user can control:

### Rain density

The editor has limited dynamic weather built in, and rain can be simulated to see the impact on lighting. Using U and I the density can be set between 0% and 100%. The rain density will affect the colour of clouds in the sky, and will also affect all in game lighting. This is an optional setting.

### Cloud density

Cloud density is similar to rain density in that the more dense the clouds, the less natural light will affect the game world. Use O and P to alter the cloud density from 0% to 100%. Altering the cloud density will also visually change the clouds to reveal more or less blue sky. Altering both cloud density and rain density will allow atmosphere changes from bright sunny days to dark, eerier scenes. This setting is optional.

### Time of day

The editor also features a basic day night cycle. Using [ and ] keys allows time to be altered backwards or forwards along a looping 24 hour clock. Time of day will affect the lighting and ambient colour within the world. The actual day and night cycle is controlled via an external data file which will be covered in detail later in this guide.

## Visual settings

At the top right hand side of the window toolbar there are a series of visual settings which can be turned on or off, as shown in figure 3 below.


*Figure 3*

At the left hand side of this section the name of the currently edited world will be displayed. To the right of this there is a selection of visual settings which allow the in-game ocean to be turned on or off to allow editing of underwater terrain, as well as controlling the editor help guide grid.

### The grid guide

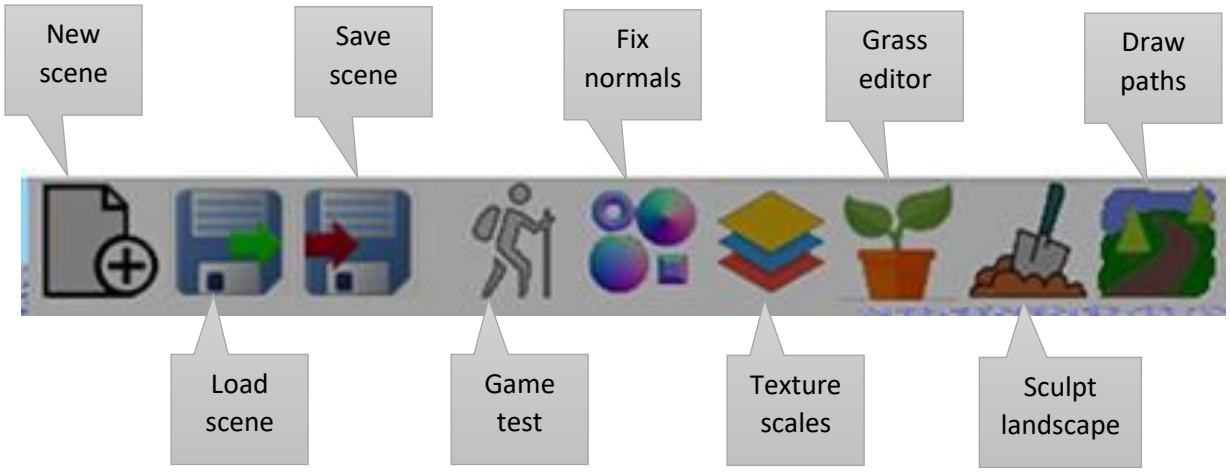
This is a visual aid which overlays a grid on the screen helps position and scale objects. By default this grid will be set to be just above the default landscape, and with a reasonable spacing. The controls can be used to raise and lower the height of the grid, or alter the size of the spacing. The grid can also be turned off altogether, or have x-ray mode enabled. When X-ray models inactive the landscape and any objects placed within the world will hide the grid where they overlap it, however turning this mode on will render the grid in a special mode where by it will always be visible but will render red where it is obscured by the landscape or an object.

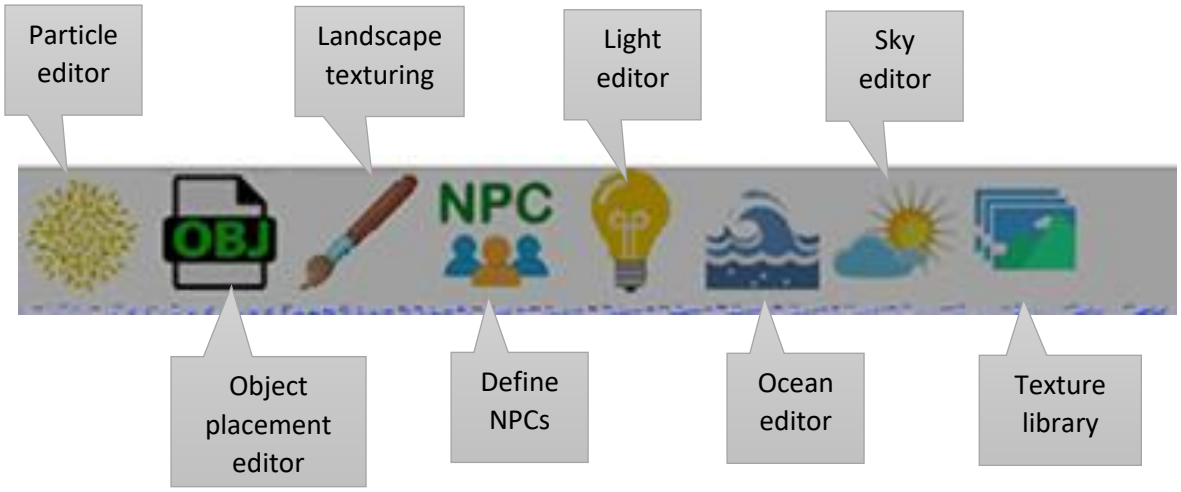
## The icon toolbar

The main functions of the editor are accessed through the various toolbar icons to the left of the menu bar, as shown in figure 4 below.


*Figure 4*

These controls give access to the various tools with some being single use functions and others opening additional menu options. Hovering the mouse over any icon will give a brief description on screen as to what each does, however figure 5 below gives an overview of each icon.



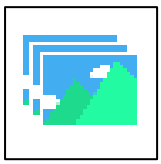




These tools allow the easy creation and modelling of the landscape, objects within the world, point lights, particle effects and NPC characters. A detailed breakdown of each of these is covered later is this guide but it is recommended to first read the sections on **object libraries** and **image libraries**.

# Image and model libraries

The World Builder is designed to function as a complex object placement editor as well as a landscape editor. For this purpose images and models are handled based around a library system so that multiple objects can be assigned the same texture to save memory, and are organised internally to match the chunk they are placed in for loading optimisation (if wished). It is important to understand how these two functions link together to facilitate scene creation.

## Image Library



The image library, shown left, is the icon which is used to manage loaded texture data. When this icon is clicked the main interface will be displayed (see figure 5) where the user can store up to 5000 textures, memory permitting. All textures loaded here are used exclusively for models and cannot be used on the landscape or for particles; these are handled separately.

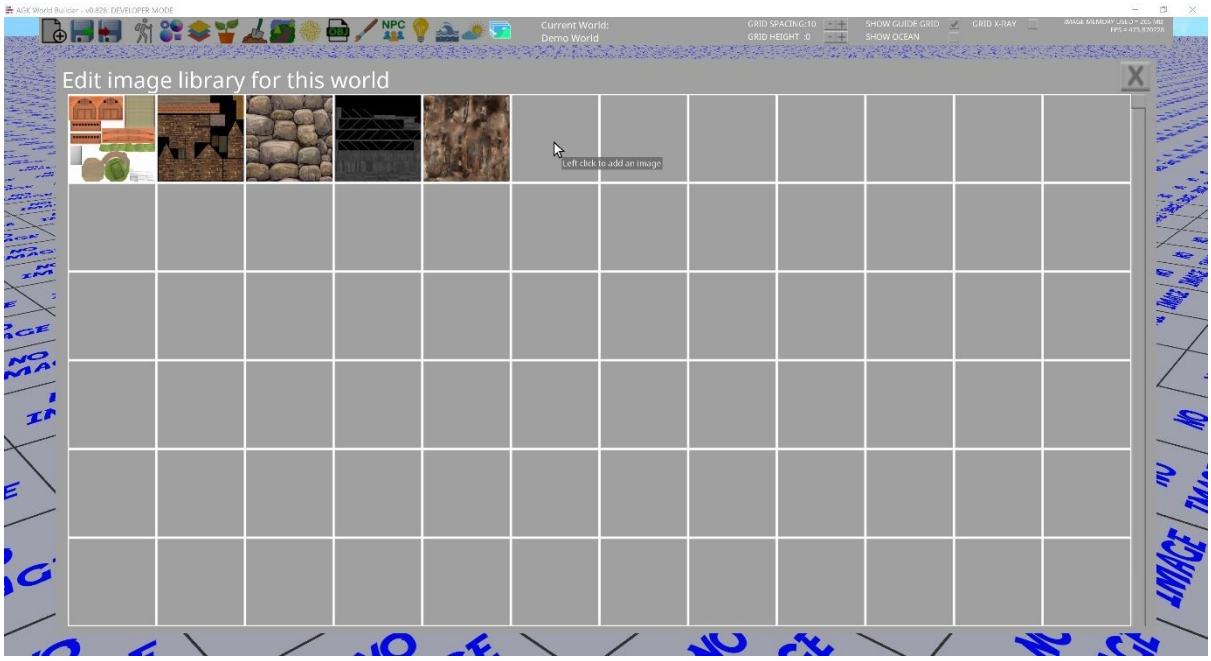
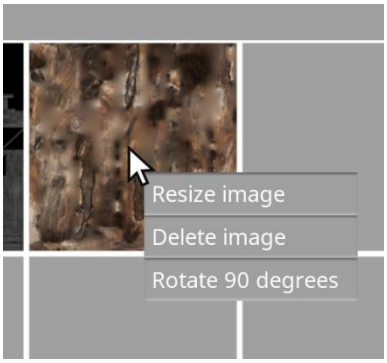



*Figure 5*

The grid will initially show as blank as no textures are loaded. At add a texture simply **left mouse click** any box to bring up a file browser to select the image you wish to load, then select it to add it to the library. All textures loaded will be saved to the save location of the current world and so do not need to be kept in the original location.

Once the texture loads in a thumbnail preview of it will display. Any loaded image can be manipulated by clicking the **right mouse button** on the thumbnail to bring up an actions menu, as shown to the right. From here images can be resized, deleted or rotated.




### Resize image

Image resizing will always round to the nearest power of two. When the dialogue box appears simply type in the dimension you wish. The entered dimension will apply to both width and height.

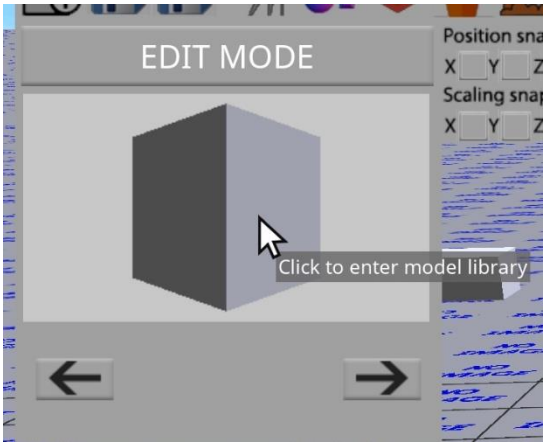
### Rotate image

Selecting to rotate the image will spin it 90 degrees to one side. This can be done as many times as wished in order to get the desired angle, or reset the image to the original angle. Note, images which have different lengths and heights will not currently rotate correctly.

Transformations to size and angle are instantly applied to any models that have the texture assigned to it. Resizing cannot be undone, however multiple copies of the same image can be loaded into different slot.

Down the right hand side of the image library there is a scroll bar which can be used to scroll through all loaded images, or alternatively rolling the mouse wheel will also shift the view up or down.

## Model library

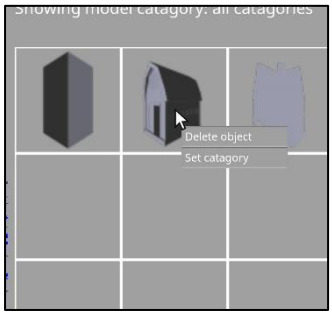



The model library is accessed from object mode. When in placement mode (covered in more detail in the model sections) there will be a thumb nail in the top right hand corner of the model currently being placed. Click the **left mouse button** on this preview to open the model library, which initially looks quite similar to the image library and functions the same way. Left mouse clicking on a box to open a file browser to add a model, with .X, .OBJ, .DAE and .FBX currently supported. Objects can have animations and multiple meshes, however the results of loading these may vary depending on the model format. For best results you should use models stored as .X for animated or multiple mesh objects, and .X or .OBJ for single static mesh objects.

Hovering the mouse cursor on top of any thumb nail preview will display the name of the object as well as the category it is assigned to, if set.

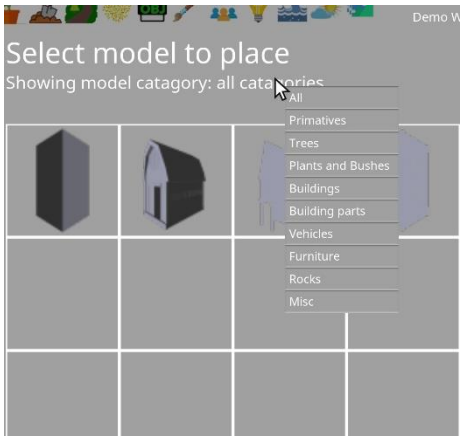
Similar to the image library, clicking the right mouse button on a thumbnail preview will present the following options shown below.

The delete option will remove the object from the library, and also any instances of that object throughout the world being edited. This cannot be undone.




Set category will allow each object to be allocated to a stock category, which can be filtered at the top of the screen. Objects can have their category reassigned as often as needed, and this will not impact any instances of the object in the world; this setting is purely to make finding models easier in complex worlds.

To set a filter left mouse click on the category label at the top of the library, as shown right. This will display only objects assigned to that category.



Left mouse click on any thumbnail to select that object as the current object to place within the world.

# Toolbar icon functions

The tool bar at the top of the screen gives access to the main functions within the editor. Each of these icons is covered in detail below.

## New world (currently not functional)

This icon is used to abandon the current world and set the editor up for a new world. At the current build this icon is not functional and clicking it will not result in anything happening. To start a new world, exit the editor and restart, then select **new world** from the splash screen.

## Load world

This icon is used to load in a previously saved world. Note that in the current build this function may result in unexpected results if it is used to load a world over the top of an already edited world.

## Save world

This icon will save the world in its current form to the save directory, under the name specified when choosing to create a new world. All loaded objects and textures will have local copies saved to this location as well so that each world is a self contained entity.

## Game mode

This mode allows the current world or scene to be tested in real time, either using a third person model or a first person camera mode. Activating this mode will present the choice of these two options, then drop the player into the world at the current camera location. Joypads / controls are supported, as well as keyboard controls. In this mode all collision will work as it would in a game environment, however day and night cycles will not progress.

During this mode the following controls are applicable:

| Action | Keyboard | Joypad / controller |
|---|---|---|
| Move forward | W | Left stick up |
| Move backward | S | Left stick down |
| Side step left (1st person only) | A | |
| Side step right (1st person only) | D | |
| Rotate left (3rd person only) | A | Left stick left |
| Rotate right (3rd person only) | D | Left stick right |
| Jump | Space | Button A / 1 |
| Run | Shift | Button B / 2 |
| Pan camera | | Right stick |

When you are finished testing in game mode simply press G on the keyboard to return to editing mode with the camera at the position it finished in during testing.

## Fix normals

This is a special control which will reset all the lighting normal data for the landscape in the current world. Holding down the **shift key** when clicking the icon will force a recalculation for the entire loaded world / scene. This is normally done automatically after functions which requite it.

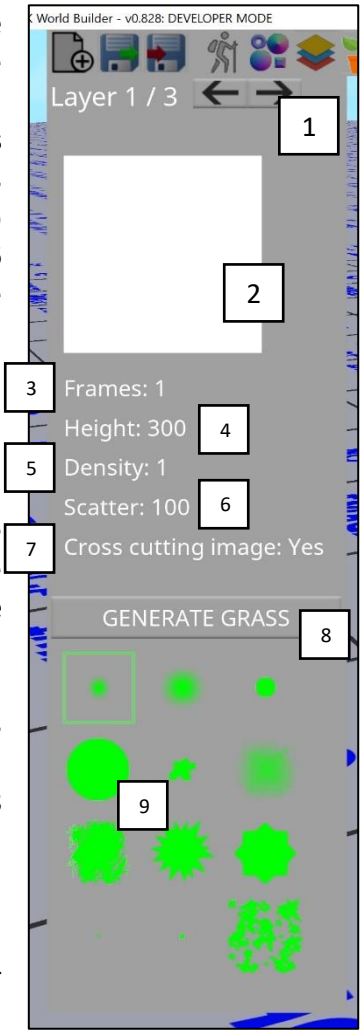
## Layer editing

This function is used to alter the texture scaling values within the landscape. Each layer of the landscape texture can have a different scale applied to it, to adjust detail levels. This function is currently redundant and awaiting revision in a later release.

## Grass editor

The editor has the ability to generate grass decals across the landscape automatically, after a small number of parameters have been set. This is a multi-function menu item, and is designed for higher spec machines or games intended to have a restricted viewing angle.

When the mode is activated for the first time the menu will look like the image shown on the right. This defines the settings which will be used to build the grass. Each chunk of the world can have a maximum of 3 layers of grass placed on it, which will be independent to any grass on other chunks. This means in total there can be 3 x 64 types of grass present by default, though each layer can have a tiled texture with up to 8 different images within it, meaning that in a standard world 1,536 types of grass can be shown. Note: the size of the image used for the grass will impact the speed it renders at, and all images should be in a PNG format with transparent backgrounds.




The controls from top to bottom are:

1. Click the arrows to toggle between layers
2. Preview of grass image. Left mouse click to bring up a file browser to choose a new image for this layer. Images should be a power of two to avoid stretching. Note: changing the image on generated grass will update the 3D model in real time, making choosing the right texture very fast and simple
3. Left click to set the number of frames in the image. For images with multiple frames, each frame should be equally sized and spaced horizontally. For example, the blow image shows an 8 frame image

4. This option sets the hight that each clump of grass will appear as. The height is dependant on the alpha of the painted zone, with shorter grass appearing where there is a fainter mask painted.
5. The density goes from 1-9 and controls how many and how close together the grass clumps will be generated. 1 is the most dense, while 9 is the least.

6. The scatter value determines how uniformly in lines the grass clumps will be generated, with a lower value creating more uniformity. The higher this number, the more randomly the grass will be placed.

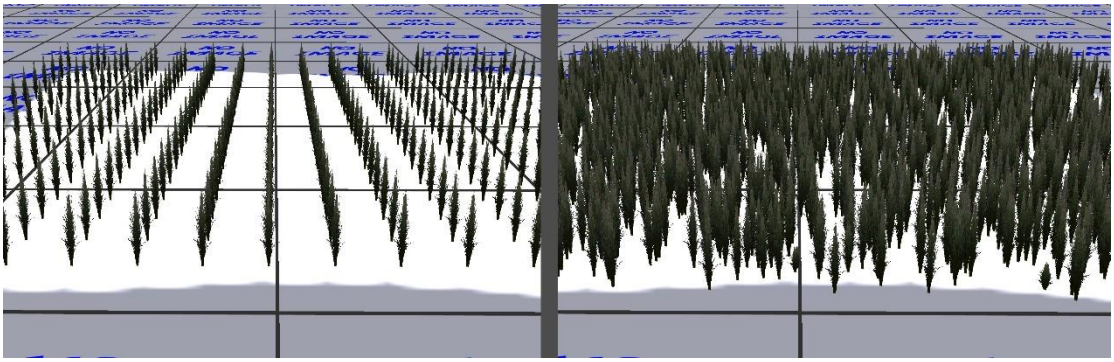


*Figure 6 - scatter of 11 vs scatter of 100*

7. If this is toggled to yes, then an additional plane will be generated at a 45 degree angle to the upright planes. This can work well for grass and help to give a better appearance from above, but does not work well with flower images.
8. This button generates the vertex data for the grass based on the current settings. Each chunk is split into four quarters, with a separate grass file being generated for each quarter. Filling an entire chunk with density 1 grass will result in patches not covered due to technical limitations of AGK. Grass can be regenerated as many times as desired, and can be removed by erasing the mask entirely and clicking to generate it again.
   Note: grass will never generate on top of drawn paths or on slopes steeper than a 45 degree angle.
9. This is the brush selection for painting the grass mask on the terrain. Select the brush you want by clicking the **left mouse button** on the brush image.

## Painting grass masks

To paint grass first choose the brush you want to paint with, then move the mouse cursor over the landscape. You will see a bright red replica of the selected brush appearing on the landscape where you point, indicating your painting zone. Hold the left mouse button down and drag it to paint onto the landscape, as shown in figure 7 below.

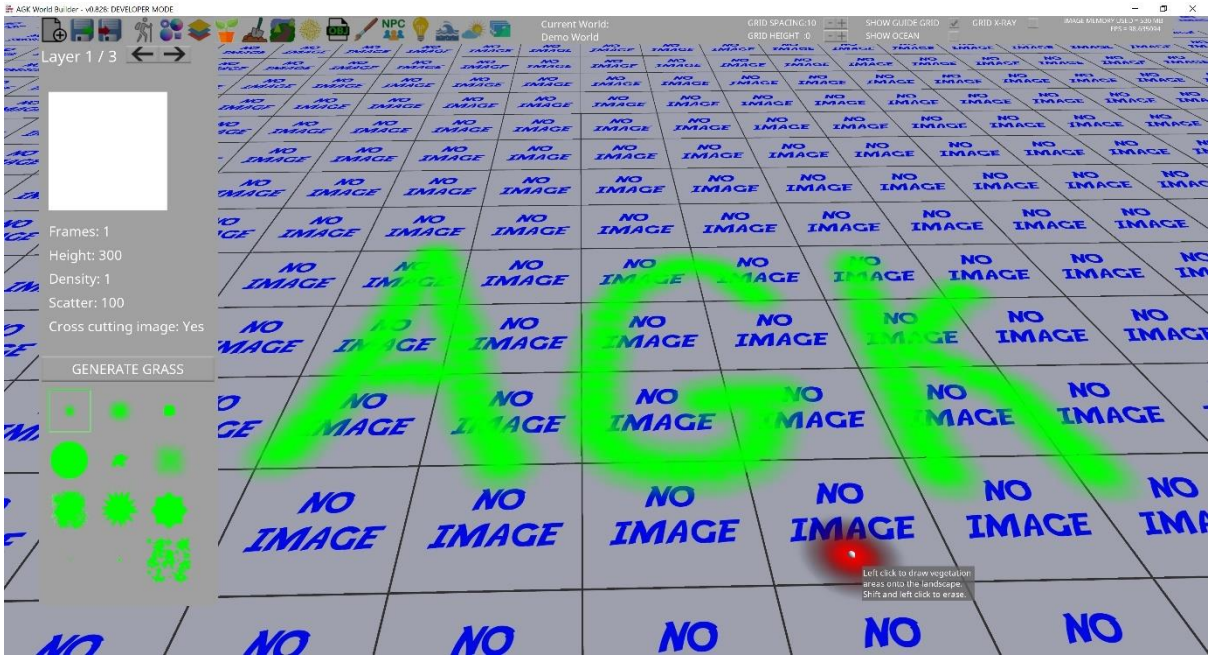



*Figure 7*

Wherever the mask is drawn on the landscape the editor will generate grass, subject to the previously declared rules and settings.

To erase an area that has already been masked out, hold down the **shift key** on the keyboard and the **left mouse button** while drawing to remove the area. The area removed will match the shape of the brush and does not need to match the brush used to paint the mask.

## Sub texture

Grass uses a separate sub texture that will always render on top of landscape textures, but below path textures. This texture will cover the masked area that has been painted, and will follow the transparency of the brush used. This texture is set on the path menu, which will be covered more in that section. The sub texture will automatically generate when you exit grass mode, either by turning the menu bar option off or choosing another mode. Below figure 8 shows the final result possible with

all 3 layers and multiple framed textures used from grass, mixing scatter and height settings.


*Figure 8*

## Grass performance

The grass is built from real 3D data, and uses a custom shader to make it move and interact with the player character, however this can have a significant impact on the frame rates achieved. The following can help speed up performance:

- Reduce the texture size – the bigger the image used, the more demanding it is to render
- Reduce the density – sometimes 3 less dense layers with the same texture will render more quickly than one very dense layer
- Try to limit areas of grass and not cover whole chunks
- Reduce the height where possible…the less that needs rendered the better

Try experimenting with different textures to see what kind of abstract and strange results you can get.

## Sculpting mode

Sculpting mode is where all the tools relating to editing the landscape are found. Entering this mode will bring up a new drop-down menu of additional controls, with the default mode being free sculpting. These tools are designed to make editing a landscape quick and easy.

### Raise / lower

This is the default tool when entering sculpt mode. This allows you to change the height of points on the landscape up or down. Moving the mouse across the landscape will show large green indicator on the centre vertex being edited, and a surrounding pattern of

yellow indicators. This shows the range of the editing influence; all the vertices within this range will be affected by the editing. See figure 9.

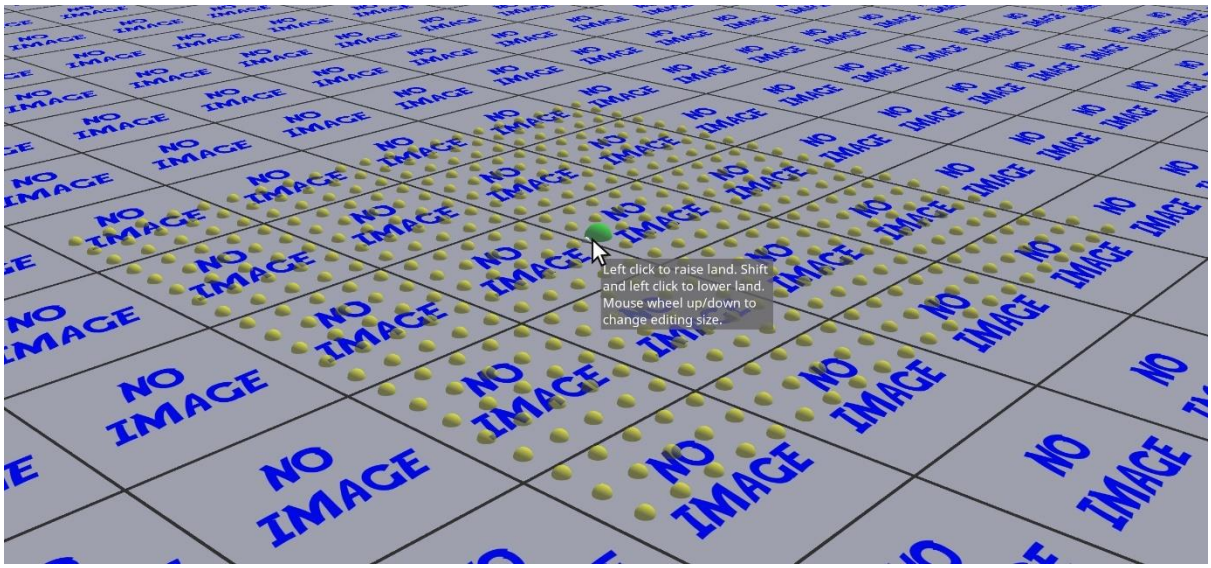



*Figure 9 – editing area influence*

Scrolling the mouse wheel up or down will reduce or increase the size of the editing area. To alter the landscape, hold down the **left mouse button** to raise the landscape, or hold down the **shift key** while also pressing down the **left mouse button** to lower the landscape. The points nearest to the green centre indicator will raise or lower faster than those further away. Note: you can use **+ and –** on the keyboard to increase or decrease the amount of change applied when pressing the mouse button.

## Fix seams

This is a function designed to remove any gaps present within the world where chunks meet. There are some tools which can cause small gaps to appear on the landscape at the seams. This function ensures there are none.

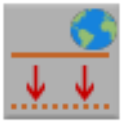
## Smooth tool

This tool switches the effect of pressing the **left mouse button** from raising or lowering the landscape to smoothing out an area around the mouse cursor by averaging the nearby vertices. Similar to sculpting, the effect will be stronger nearer to the green centre indicator. Holding this down indefinitely would eventually lead to a perfectly smooth area.

## Smooth chunk

This function performs an even degree of smoothing across all the vertices in the entire chunk in one go. This is very useful if you have rapidly drawn a landscape which is quite rough, or post importing a height map which was not auto smoothed. Holding down the **shift key** while pressing this function will force the entire world to be smoothed off. This should generally be done early in the creation of a world as placed objects will not automatically adjust to any alteration of the landscape height.

## Raise land and lower land



The raise and lower land functions will uniformly raise or lower the entire chunk by a single step. The amount the chunk will raise or lower is dependant on the amount of force set using the **+ and –** keys. Note: objects will not

automatically adjust to landscape height adjustments so this is also something which should be done early on in world creation.

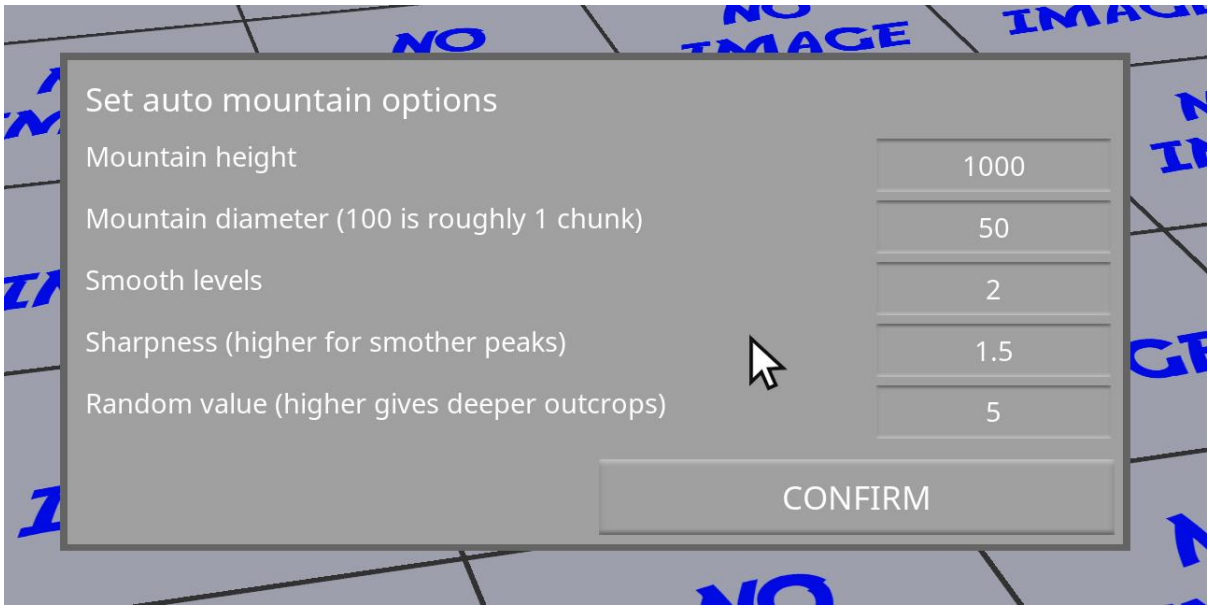
### Levelling tool

The levelling tool is designed to allow rapid adjustments to the landscape to bring it to a fixed height. The area of effect will be represented by red spheres, with bright red spheres being above ground level and dull red ones being below ground level. This tool has two functions; raise and lower. Hold the **left mouse button** down to raise any landscape points currently below the red indicators up to that level. Hold down the **shift key** and the **left mouse button** to lower any points currently above the red indictors to that level.

The height points are raised or lowered to is adjusted by scrolling the mouse wheel forward and backward. The area of effect can be set in sculpting mode using the mouse wheel prior to going into levelling mode.

### Auto mountain


This tool is designed to allow the quick generation of random mountains and hills. Entering this mode will turn the mouse cursor into a single green sphere, indicating where the centre of the mountain will be. Once the desired spot is found, click the **left mouse button** to open the parameters windows, as shown below.




- Mountain height: sets the overall maximum height of the construct
- Mountain diameter: sets the width of the mountain at the lowest point
- Smooth levels: how many times the construct should be auto smoothed. Note: this will not smooth the rest of the chunk around the mountain
- Sharpness: this defines if the mountain should have a taller, slimmer peak or a smaller, more hill like appearance
- Random value: this value will make the declines of the mountain more or less jagged

Once the desired parameters are set click **CONFIRM** to generate the mountain. Mountains can cross over chunks, and all seams and vertex normal are fixed during the process. Pressing **escape** will exit the form and cancel generation.

## Import heightmap


This function allows a height map to be automatically imported and stretched across the entire landscape. When selected you will be prompted to confirm you wish to import a heightmap. Note: this will erase the entire world and cannot be undone. Once confirmed you will be prompted to allow smoothing or not. If you turn on smoothing the imported heightmap will automatically have smoothing applied across the entire world.

After these steps a file browser will open prompting you to choose a height map to install. Simply navigate to the image file you wish to import and select it. Once a file has been chosen you will be asked to set the maximum height of the landscape. All imported height maps will stretch from level zero to the height you specify, based on the image data.

The world will build on screen in front of you, after which it will smooth if selected, then fix all normal and seams.

## Draw paths

This tool allows the creation of paths within the world. Paths are drawn based on a hierarchy with themselves and other drawn elements such as terrain textures or grass. It is possible to set three path textures, all of which will drawn on top of all other textured areas, and in order of sequence with texture one at the bottom. Paths will also prevent grass from generating on them, within the confines of the random setting of the grass.

When you enter path mode, the interface shown to the right in figure 10 will appear. This works in a similar fashion to the landscape texturing, and the textures for the individual path layers are set by clicking the **left mouse button** on one of the slots at the top [1]. This is also where the texture for the base grass is set, as the first texture. Path and base grass textures are unique to each chunk of the world. Scroll the mouse wheel forward and backward to cycle through the path textures for painting.

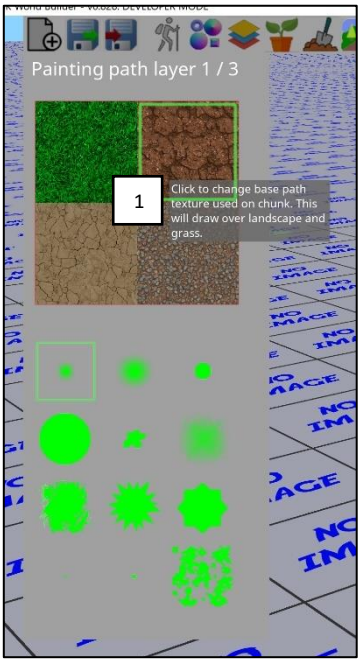


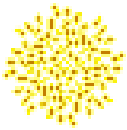

*Figure 10*

Below this is the brush selection panel where the type of brush to be used to paint in the world is set.

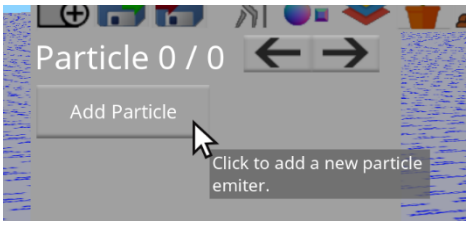
To place paths select the texture and brush desired, then hold down the **left mouse button** on the landscape to paint. To erase a path hold down the **shift key** and the **left mouse button** to rub it out again.

Below is a sample of how the paths will draw, with some simple grass as a demonstration. Note that the paths appear on top of each other in order from top left to bottom right, and how the grass does not grow over the top of paths.

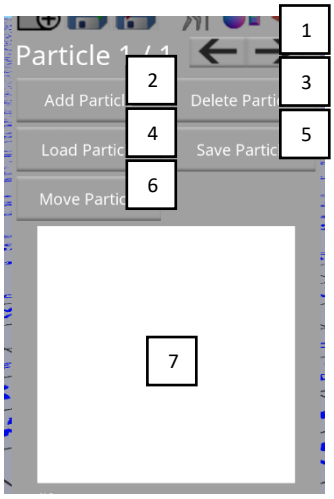

## Particle editor



The particle editor allows the placement of AGK particles within the world. All particle functions are definable within the editor, and can be placed anywhere. The particle editor allows a rapid visual editor for the creation of all AGK particles, which are saved off with any saved world or scene. When you first go into the particle editor there will be no defined particles, so you should press the **Add Particle** button be begin creation. From here moving the mouse cursor around the screen will place a green sphere at the first impact under the mouse cursor; particles can be attached to either the landscape or any objects placed within the world, even if the objects are set not to allow collision. Click the **left mouse button** to place the particles in the world.




Once the particle is placed, a small number of opaque white squares will emit from the location and a wide range of options will become available, as shown right. The top sections controls the following:




1. Cycle through all placed particles
2. Add a new particle
3. Delete the current particle
4. Load a saved particle
5. Save the current particle. This will save the texture and all settings, but not the location
6. Move the particle to a new location by selecting with the mouse. Note: particles also have a 3D widget that can be used to move them by holding down the **left mouse button** on one of the 3D arrows and moving the mouse
7. Click here to choose a texture for the particle

Below these controls are a wide range of options which allow the parameters of the particles to be set, and **scrolling the mouse wheel forward and backward** will scroll through all available options.

Changing any of these particles will result in a regeneration of the particle for a simulated period of time so that the changed effect can be seen in real time. The options are as follows:

- Lifespan – how long the particle will appear on screen before vanishing
- Frequency – how often a new particle will generate
- X/Y/Z force – how far in each direction each particle should move
- Direction range ½ - a maximum amount of random movement along the X and Y axis that the particle should start within
- Velocity minimum and maximum – the slowest and fastest speed each particle should move at
- Maximum particles – NOT FUNCTIONAL AT PRESENT
- Particle size – how big each particle should be
- Transparency – allows toggling of transparency on and off
- Particle start zone – this defines the starting area of each particle. When entering a sub menu will open that allows the user to alter the X/Y/X dimensions of a red cube on screen. Particles will randomly generate from within this cube
- Set force 1-5 – these allow the user to set additional forces to impact the particle, and when they should start
- Colour range 1-5 – these allow the user to set additional colour changes to affect the particle, and when they should start
- Scale change 1-4 – these allow the user to set additional scale changes to affect the particle, and the time by which it should take effect

Figure 1 below shows a simple smoke stack effect applied to a particle, using a combination of all the settings. Particles can be demanding in system performance, and care should be taken not to over use these on lower powered devices.

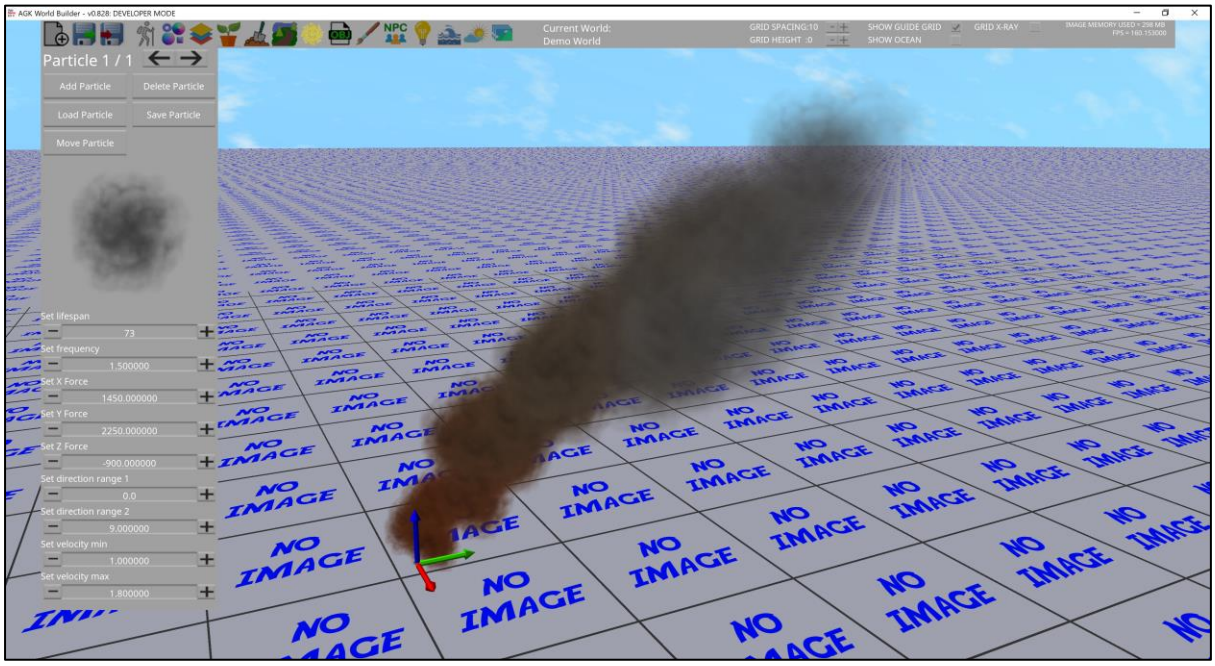
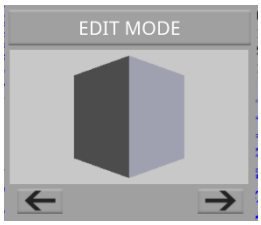



*Figure 11*

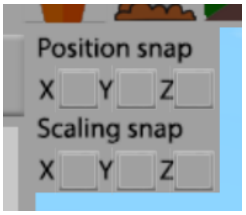
## Object placement editor

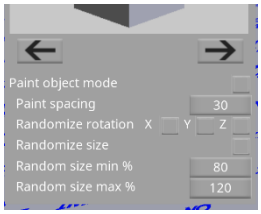

The object placement editor is where the main scene editing facilities of the World Builder are found. All objects loaded through the model library are placed and edited in this mode. The editor supports animated and multiple mesh objects of various formats however it is recommended that .X or .OBJ objects are used for static, single mesh objects, and .X is used for animated or multiple mesh objects. Other object types are supported if supported by AGK however results can vary.

### Placing and selecting objects




The initial placement of an object is quite simple; simply use the arrow keys beneath the icon snapshot to select the object you wish to place, or via the model library, and move the mouse over the screen. The selected object will automatically follow the landscape or other placed objects. Once you are happy with the location press the **left mouse button** to add the object to the world. To the right of the object preview are a small selection of tools to aid in placement, which can be clicked to toggle them on or off. Snapping via position will move the object locked to the current grid along each selected axis. Scaling will scale the object evenly along the selected axis. Objects are added based on the chunk their centre is within the bounds of when placed and will load accordingly.




Underneath the current object snapshot there are some additional objects to help with the rapid placement of multiple simialar objects, referred to as object painting. Simply check the box to turn on object painting. While in this mode, click and hold down the **left mouse button** to paint multiple instances of the object under the mouse. Each painted object will be a unique entity, and all of it's properties can be edited like any other placed object. You can toggle the other options below this to do the following:

- Paint spacing – this determines the minimum distance that must be between the last painted object and the new object location, in all directions. When the first object is painted, this is represented by a semi-transparent sphere and the object attached to the mouse will turn red. Click the **left mouse button** on the number to change this value
- Randomize rotation – tick the X, Y and Z boxes to randomize the rotation of each object on that axis. For example, placing trees with the Y axis randomized will rotate them all randomly on that axis so they do not appear to be clones of each other
- Randomize size – ticking this option will scale each new instance of the object randomly, within the min and max parameters set underneath it. Click the **left mouse button** on one of the numbers to change the value. Minimum ranges from 10% to 100%m and maximum from 100% to 1000%. The scale will be based on the current displayed on screen item, so changing the preview scale will change the scale of any further painted objects

Clicking the **EDIT MODE** button above the object preview will toggle in and out of detailed editing of placed objects. When you enter this mode a new interface will open, and you will be placed in selection mode. Move the mouse cursor over any placed objects and it will turn pale green to indicate it can be selected, as shown in figure 12 below.

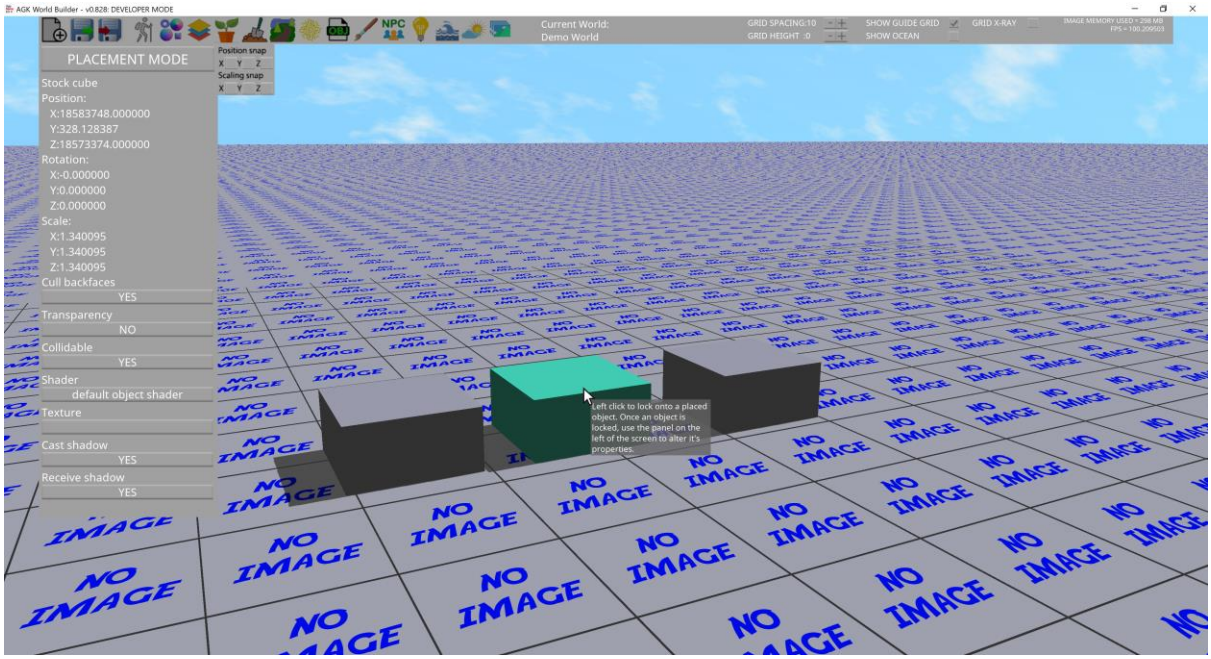



*Figure 12*

Click the **left mouse button** on the object to lock it. Doing this will present further options down the right-hand side of the control panel and will display the 3D widgets for placement, scaling and rotation as shown below in figure 13. **Left mouse clicking** the object again will release the lock.

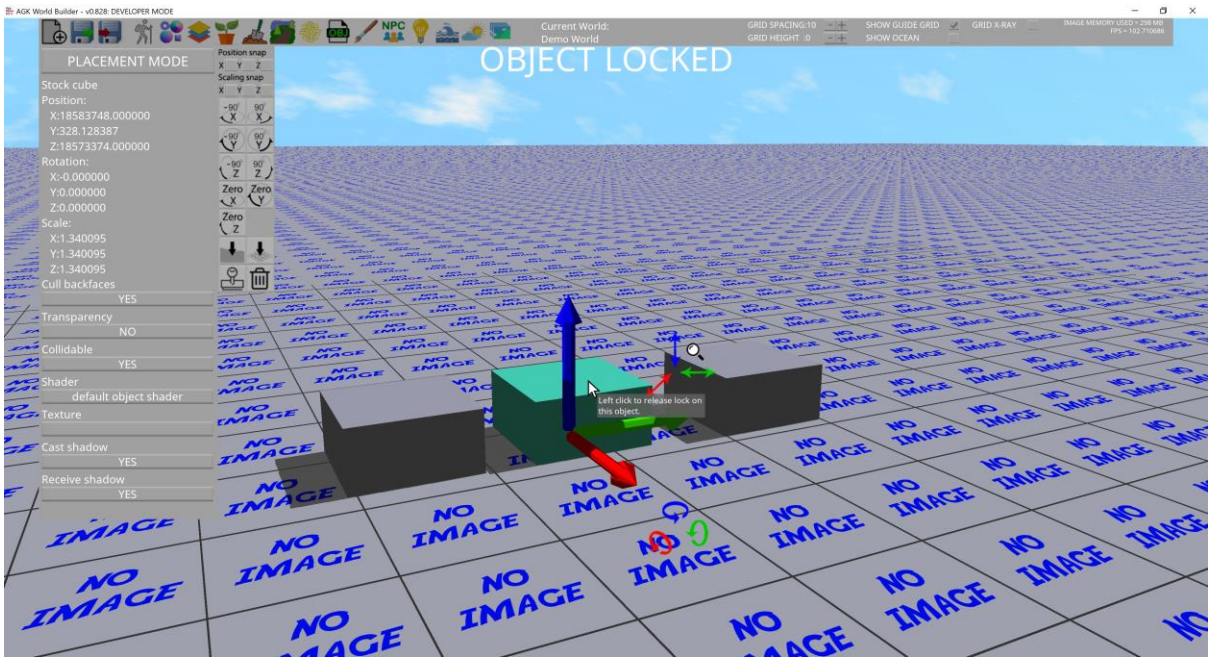
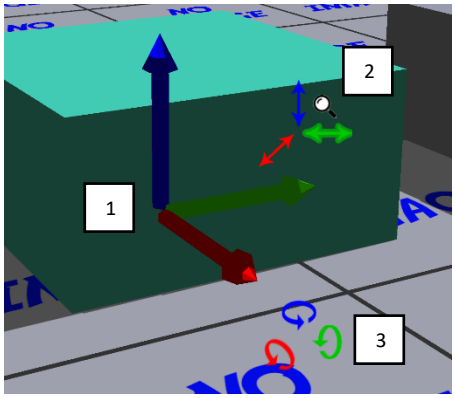



*Figure 13*

## Movement, scaling and rotation



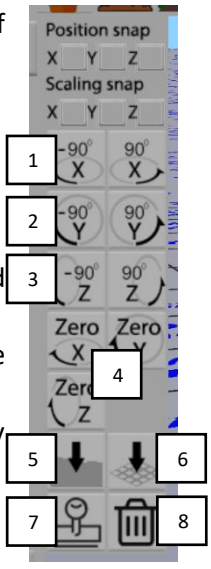

When an object is locked, an array of control widgets will appear on the screen on and around the object.

Center to the zero point of the object will be large red, blue and green movement arrows [1]. Clicking and holding the **left mouse button** while on top of one of these arrows and moving the mouse will the object in that direction along the relevent axis. Note: if movment snap is turned on the object will only move in snapped increments.

To the top left of the movement controls are the scaling controls [2]. Clicking and holding the **left mouse button** on one of the arrows and moving the mouse will allow the object to be scaled in that direction. Holding down the **shift key** will making the scaling action far slower for precision scaling. When an item is locked the **mouse wheel** can also be scrolled forwards and backwards to scale in all directions equally. If scaling snap is turned on for any axis then using the mouse wheel will only scale the object along the selected axis, and always in line with the current grid scale.

To the bottom right of the movement controls are the rotational controls. Clicking and holding the **left mouse button** on one of these controls and then moving the mouse will allow the object to be rotated in that direction. Holding down the **shift key** will making the rotation action far slower for precision positioning.

## Additional placement controls

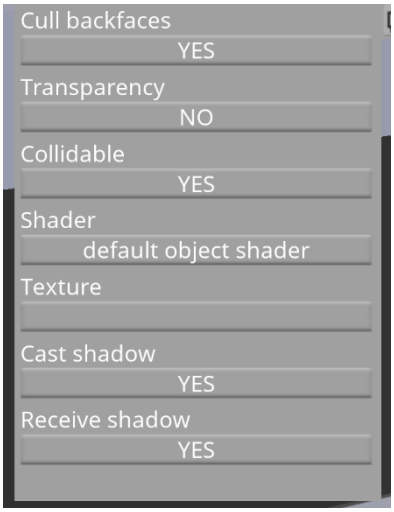



Below the snap controls an additional controls panel will open up with a number of helpful positional tools. These are:

1. Rotate the object by exactly -90 degrees or plus 90 degrees on the X axis
2. Rotate the object by exactly -90 degrees or plus 90 degrees on the Y axis
3. Rotate the object by exactly -90 degrees or plus 90 degrees on the Z axis
4. Rotate the object back to zero on the X, Y or Z axis
5. Place the object on the ground; will place the object at the height of the ground on the Y axis, based on the zero point of the object mesh
6. Similar to placing the object on the ground, but this will place the object on the current grid height
7. Clone the object; will create an exact copy of the current locked object slightly offset to the position of the locked object
8. Will delete the object from the world

These controls are only available when an object is locked within the world.

## Visual properties




At the bottom of the main object panel are the controls for setting visual properties for the locked object, as shown right. These controls allow various visual properties of the object to be defined.

- Cull backfaces – this setting determines if the object should cull off rear facing triangles for a placed object, i.e. faces which are not facing the camera
- Transparency – defines if objects should have transparency or not. Object textures should have an alpha channel value (PNG) in order to use this function
- Collidable – determines if the object will allow interaction with other objects in the game world. For example, turning this on for trees and off for small bushes will let the player walk through the bushes but be stopped by trees
- Shader – set the type of shader to be used on the object. Current options are:
    - Default shader
      Expects a single diffuse texture loaded into texture slot 0, and uses model UV data
    - Tri planar shader
      Expects a single diffuse texture loaded into texture slot 0, but ignores UV data and tries to apply the allocated texture evenly on all surfaces. Does not work on moving objects
    - Normal and specular shader
      Expects a diffuse texture in slot 0, a normal map in slot 1 and a specular map in slot 2. This applies a lighting effect to the object that can make them look far more visually attractive, but with slower performance on low powered devices (see figure 14)
    - CUSTOM (currently not functional)

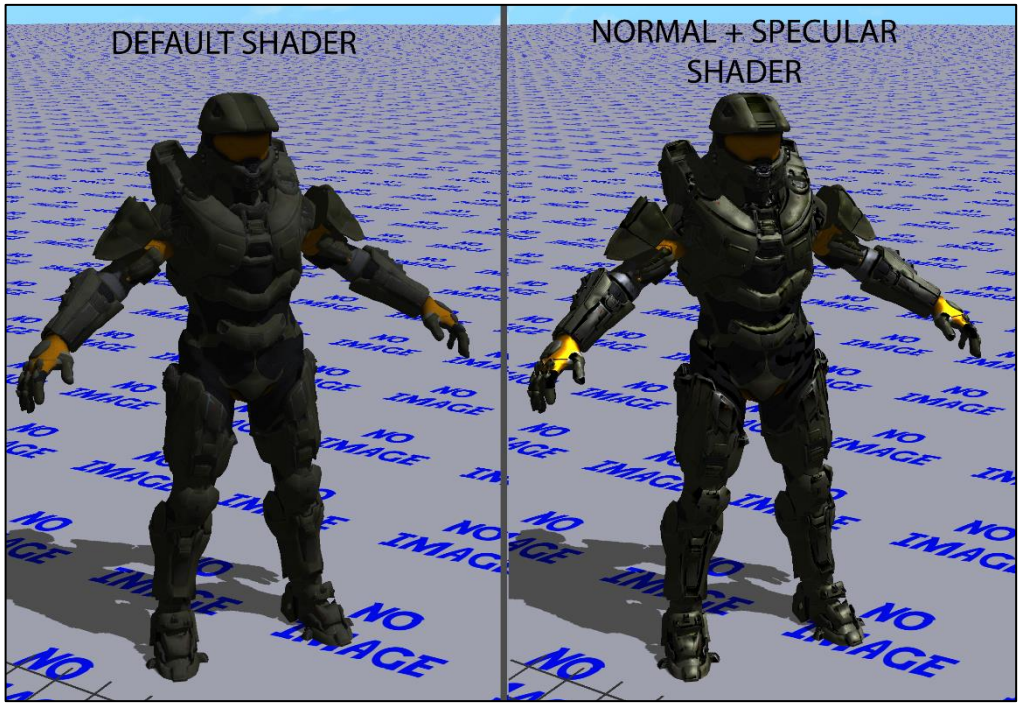



*Figure 14*

- Texture – opens the texture editor

- Cast shadow – turns on or off the ability for this object to cast a shadow within the world
- Receive shadow – turns on or off the ability for this object to be affected by shadows cast by other objects within the game world

## The texture editor

Texturing of objects is handled within a special editing menu accessed by clicking the **Texture control** when an object is locked. This screen looks like figure 15 below:

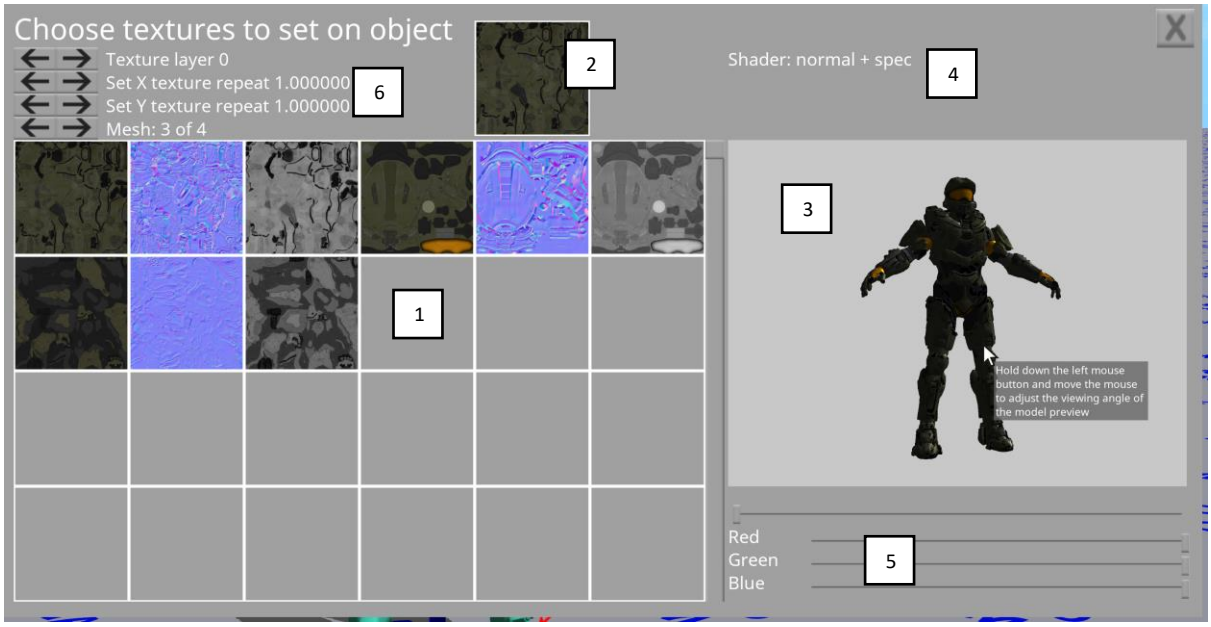



*Figure 15*

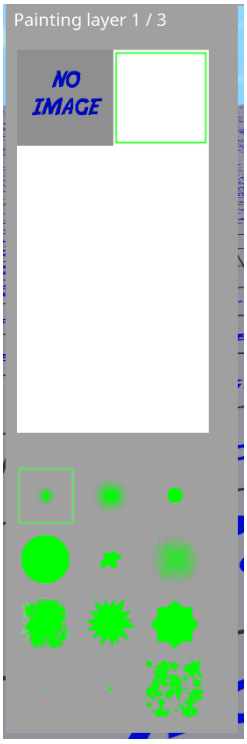
The controls in this screen allow all aspects of the textures for the object to be defined and controlled. The main central display [1] shows all the currently loaded textures, and functions in a similar fashion to the image library. Clicking the **left mouse button** on any texture will set it to the current stage of the current mesh. Clicking an empty slot will remove the current texture allocation from the active slot on the active mesh. To the right of the preview grid is a scroll bar which can be used to scroll through the library. Alternatively scrolling the **mouse wheel** forwards or backwards will also scroll through the texture library. A preview of the texture currently applied to the selected mesh and layer is shown at the top [2].

To the left of the texture preview is a window which shows a preview of the current model [3], rendered with the current lighting based on its position in the game world. Click and hold down the **left mouse button** in this window and move the mouse to rotate the view to any angle. Above the preview window the currently used shader is displayed [4]. Clicking the **left mouse button** on this will open a drop-down menu to allow the shader to be changed here for ease. Below the preview sliders allow the colour of the object to be altered [5]. Click and hold the **left mouse button** on the control and drag left to right to set the value. All values affect all object meshes.

At the top right-hand corner [6] are the controls to change the currently edited texture layer (0-7), the X and Y scale of the texture (default shader and normal + spec shaders only), and the current mesh being edited. To change a setting click the **left mouse button** on an arrow to decrease or increase its value. For texture scaling the **left mouse button** can be held down to change more rapidly.

## Landscape texture painting

This mode allows the painting of textures on the landscape. Painting in achieved by setting up to 8 textures and then using the mouse to paint them directly onto the landscape where you wish them to appear. Upon starting a new world the interface will load up looking like the image to the right. The panel represents the 8 possible textures which can be set for this chunk, with each chunk able to have textures set completely independently to each other.




The top left, or base layer, will always be the bottom most layer drawn, with layers then numbered 1-7 starting at the top right and moving down then to the right. Hovering the mouse cursor over the tile panel will display a tooltip to note which texture is which. The important thing to note is that all textures will render in numerical heirarchy upwards. This means layer 1 will always cover the base layer, layer 2 will always cover layer 1 and the base layer, and so on.

Click the **left mouse button** on one of the 8 tiles to open a file browser and choose the image to load in. Images which are not a power of two will be made to be, and all work needed to atlas the texture seamlessly will be done, however textures will not be altered automatically to repeat.

Scroll the **mouse wheel forwards and backwards** to change the current texture being painted, as noted by the green square highlight.

Underneath the image selection pane is a series of paint brushes which can be used to physically paint onto the landscape. Click the **left mouse button** on one of the brushes to select it.

Once you are ready to start, mov the mouse cursor over the landscape and begin painting by holding down the **left mouse button** and moving the mouse cursor. The landscape will be painted in the shape of the brush under the mouse. To remove a previously painted decal, hold down the **shift key** and the **left mouse button**. When erasing painted decals, the current brush shape will be used however the painted layer will only partialy erase with each press; this allows a smoth fades to be applied. For example, you can paint the texture with a solid brush, then erase parts with a shaped brush to get a patchy, smooth fade through as shown in figure 16 below. Erasing will only remove the painting decal for the selected layer, not all layers.

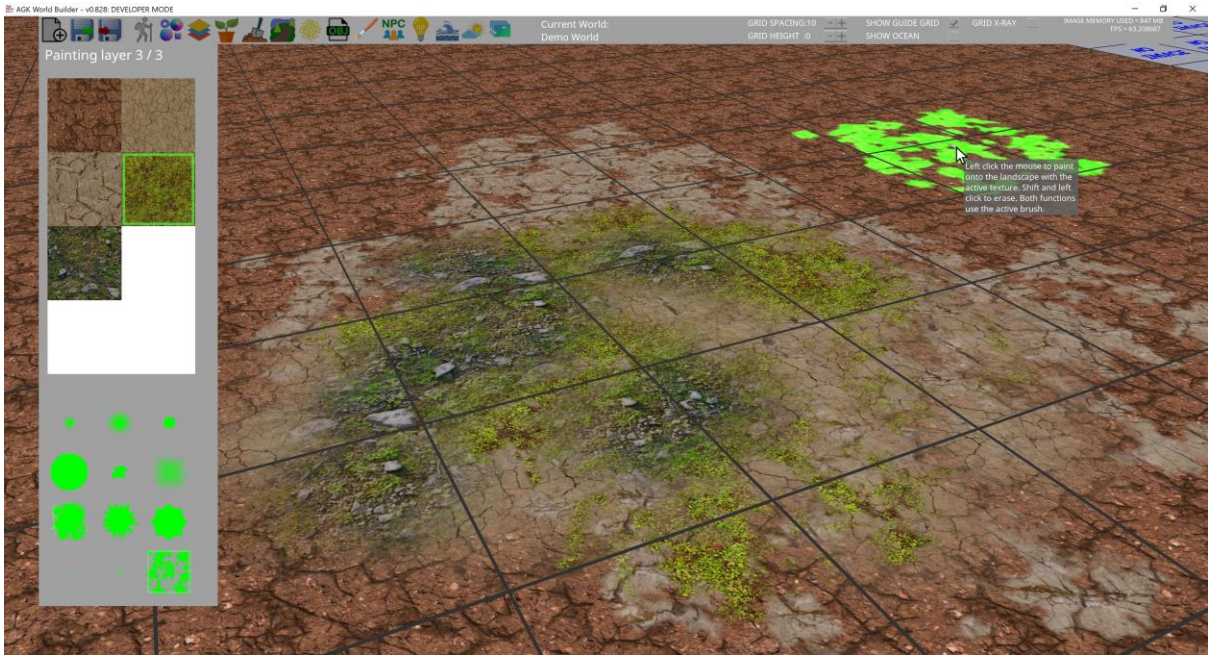



*Figure 16*

## NPC definition and path setting


THIS SECTION IS UNDER REVIEW AS THE FUNCTIONALITY MAY BE REMOVED.

## Lighting

The lighting editor allows the creation of lights within the world. Entering this mode opens a new menu that allows up to 1000 lights to be defined within the world, and all parameters set. When first entering the lighting function no options are available as no lights will have been defined. Clicking the button marked **ADD LIGHT** will enter placement mode.

### Placing and moving lights

When a new light is created it is placed by moving the mouse cursor over the world to set its position, which will be indicated by a green sphere. Click the **left mouse button** to set the initial location for the light, at which point 3D widgets similar to object mode will appear (see figure 17). Clicking and holding the **left mouse button** over the arrows while moving the mouse allows light positions to be freely altered.

The control menu down the side also has a button marked **Move light** that can be used to set a new position by attaching the light to the mouse cursor again.

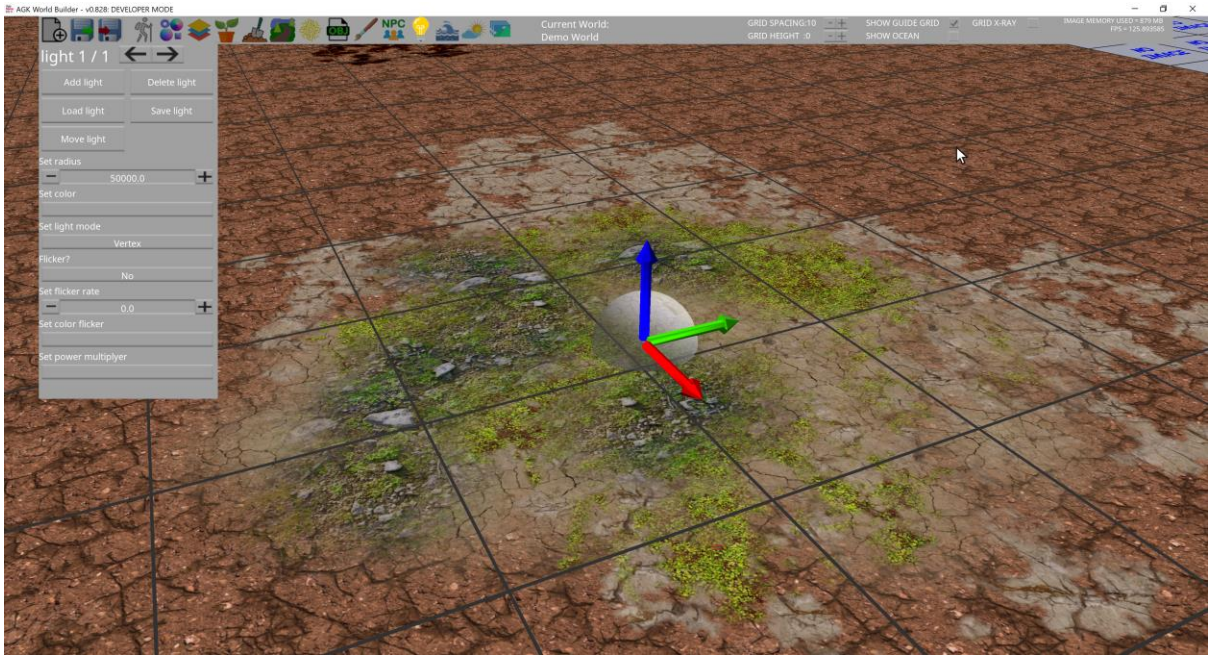
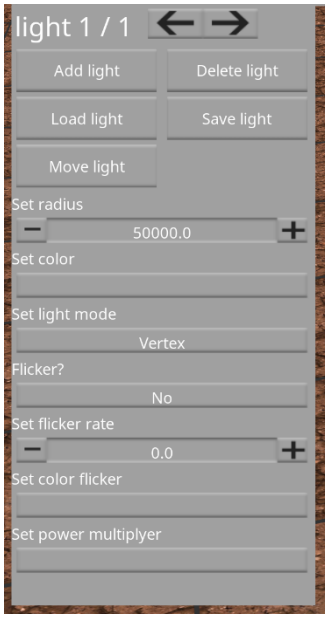



*Figure 17*

## Configuring a light

The control panel on the left hand side of the screen allows the properties for lights to be set. These controls are as follows:




1. Use the arrows to swap between lights
2. Add a new light
3. Delete the currently active light
4. Load a previously saved light
5. Save the current light. All properties except the light position will be saved for later use
6. Set the position of the light using the mouse
7. Set the radius of the light – this controls the sphere of influence of the light, and is illustrated on screen by a semi transparent sphere – the bigger this range, the further away objects can be while being affected by the light
8. Set the light colour. Clicking this control will open a separate panel with 3 sliders to control the RED, GREEN and BLUE values of the light colour. Click and hold the **left mouse button** and drag to change these, then click the **right mouse butt**on to exit when done
9. Toggle vertex and pixel lighting. Pixel lighting looks better but can be slower on less powerful machines
10. Set the light to flicker – NOT CURRENTLY FUNCTIONAL
11. Set flicker rate - NOT CURRENTLY FUNCTIONAL
12. Set color flicker - NOT CURRENTLY FUNCTIONAL
13. Set power multiplier – this open a separate panel with a slider that allows a power multiplication to be set. Click and hold the **left mouse button** and drag to change this, then click the **right mouse butt**on to exit when done. The higher the power multiplier the more intense the light will be. Think of this as the wattage of the light

Figure 18 below shows a simple lighting effect and how it influences a nearby model. Lighting will affect all objects within the world, as the ocean if turned on. Note: lights are point lights only and objects will not mask or block the lighting behind then due to AGK limitations.

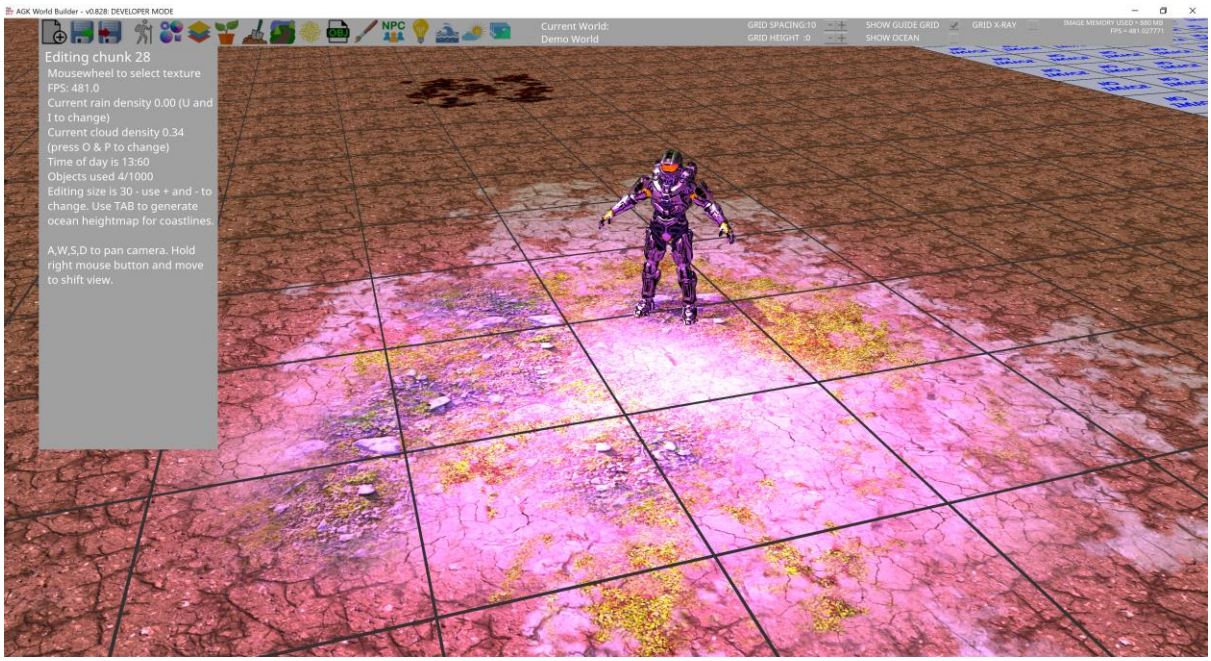



*Figure 18*

## Roadmap

The World Builder will continue to evolve, both through features needed for internal development and requested features. Currently planned are:

- Full control over oceans – defines textures and a custom shader
- A faster, built in water shader designed for a more traditional look and feel
- Full control over skies – choose your type of sky – flat or convex sky globe
    - Control over clouds
    - Ability to use a custom shader if wanted
- A shader library, similar to current texture and model libraries
- Full control over configuration of day / night, lighting, shadows, texture detail etc
- Full exporting options – ability to export individual features, such as just model placement, and at a range of qualities; export a high end PC pack or a mobile pack
    - Full source code supplied in the form of a function to load worlds in your own programs, and basic game engine code supporting 1st or 3rd person
- More advanced model editing tools:
    - Auto generate ground stones / rocks similar - to grass now
    - Allow randomisation of object meshes
- Ability to auto-combine identical meshes into a single draw call for the fastest speed possible
- More advanced shaders
    - Better tri planar
    - Parallax mapping
    - Light shafts
    - Directional lights, including masking

    - Placed lights linked to built in shaders
    - Enhanced and redone day night cycle
- Built in cut scene editor to build your own cutscenes and animated sequences
- Multiple world styles – set chunk layout to accommodate side scrolling levels or single chunks for object placement