

L.V.E 2023 Lava & Volcano Environment 2023 Tutorial

Lava & Volcano Environment 2023



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Important words at the start about both assets

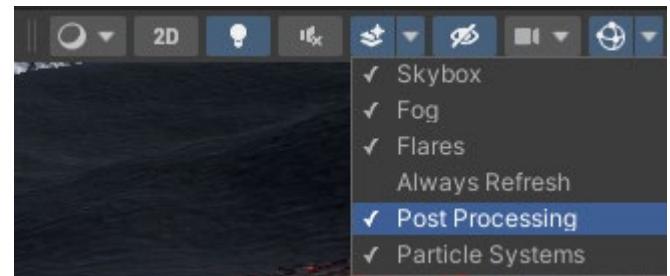
If you want to use L.V.E 2023 splines with old R.A.M 2019 please remove or do **not import whole additional tools and spline system folders from R.A.M 2019**. Water shaders will work without using 100% new features from the system in the 2023 version. Be patient and wait for spectacular R.A.M 2023 😊

As we create many tools and shaders we try to share the same technology between assets to avoid mess in your project.

Tools and systems mentioned in this doc are shared between L.V.E and R.A.M If you will be common with one of these packs for sure you will not have problems with the other one or any other future packs. As we like to say – one spline to rule them all!

We made a few demo scenes to show different setups and possibilities.

To see how the surface moves and to notice lava emission in the scene view you need to keep image effects turned on in the scene window.

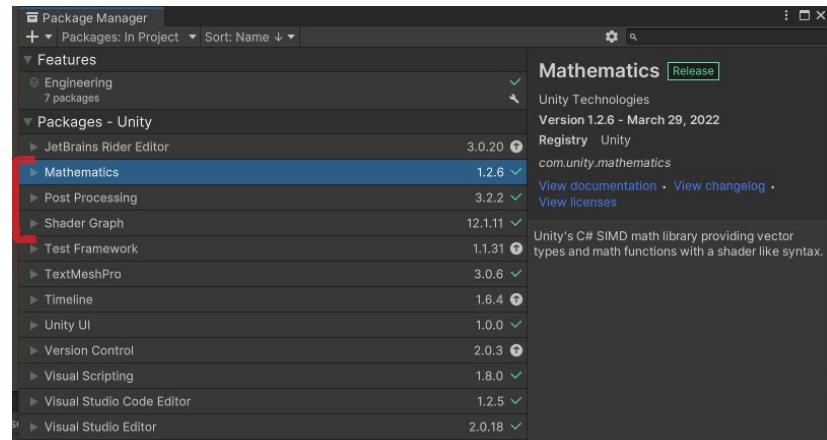


Lava shading needs a bloom image effect at the scene, emission shows up and reacts with the screen only when the bloom is turned on. This is how the engine works with emissive materials. Be sure then that you have a bloom effect from post-process stack or other sources. Bloom power will also affect emission behavior so you have to find a balance between bloom power and emission power. We suggest setting up emissions on non-emissive areas to reasonable values and then playing with emission power at materials. We set up our materials to pretty standard values so there should be no or small adjustment in emission values.

Import

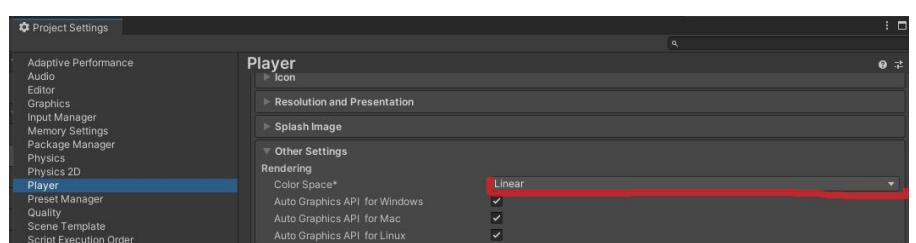
1. Built-in (Standard)

- After you import our asset please import plugins from the unity package manager: **Window -> Package Manager**
 - Mathematics:** advanced spline systems need this for calculations.
 - Post Process Stack:** To render emission effects and proper render;



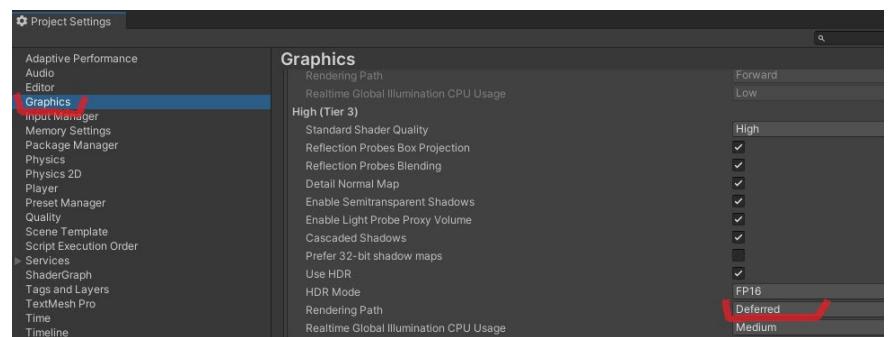
For **HD** or **URP** you don't need to install any of these plugins as they are already inside the engine.

- We advise using linear render instead of gamma as it works correctly with post-processing and it's more flexible.



Edit->Project Settings-> Player -> Linear

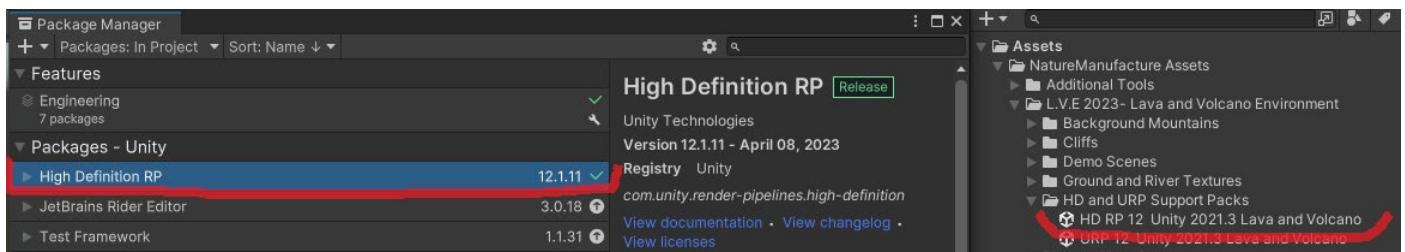
- Best performance you will get with Deferred render. Each reflection probe and light duplicate the number of verts at Forward render so more complex scenes should use deferred. Performance is x2 better with deferred.



2. HD RP

- After you import our asset to your HD RP project you have to import an HD support pack. It contains prefabs, materials, shaders, and profiles directly for specific HD RP and Engine versions. You can find it in HD and URP Support Packs folder.

HD RP is fluid so support files from 2021.3 may not work in 2022.3. That's why we prepare files for most/each engine version.



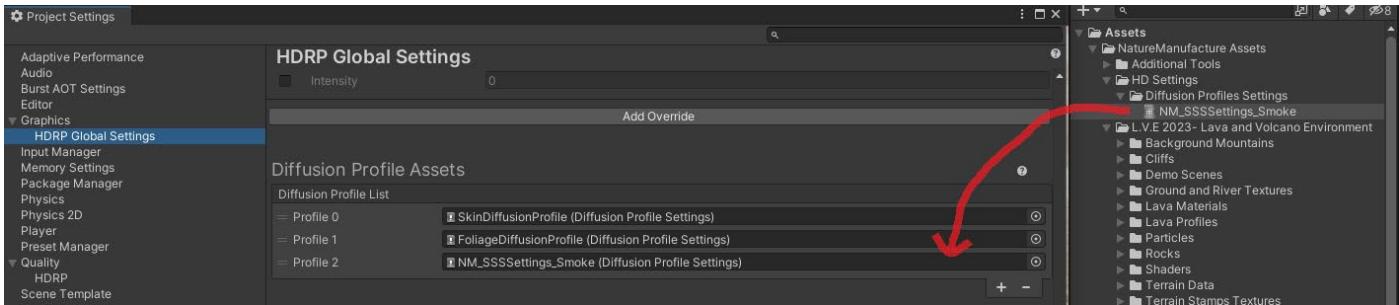
- After you import the support pack you have to add subsurface profiles to **Edit -> Project Settings -> HDRP Global Settings**. These profiles contain info about translucent materials like smoke. Without it, all particles like smoke will render in debug mode.

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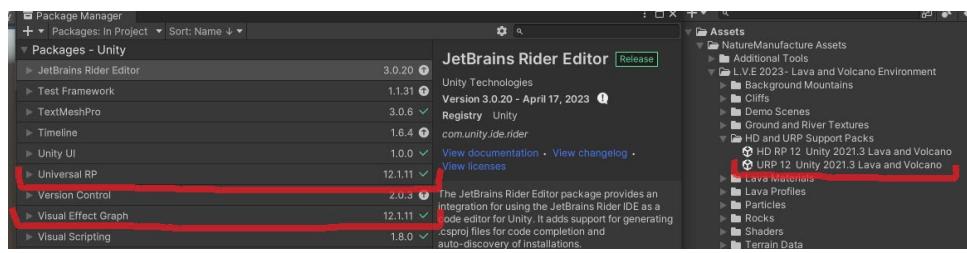
- Notice that HD RP is changing all the time and these options may migrate from place to place in different engine versions.

3. URP

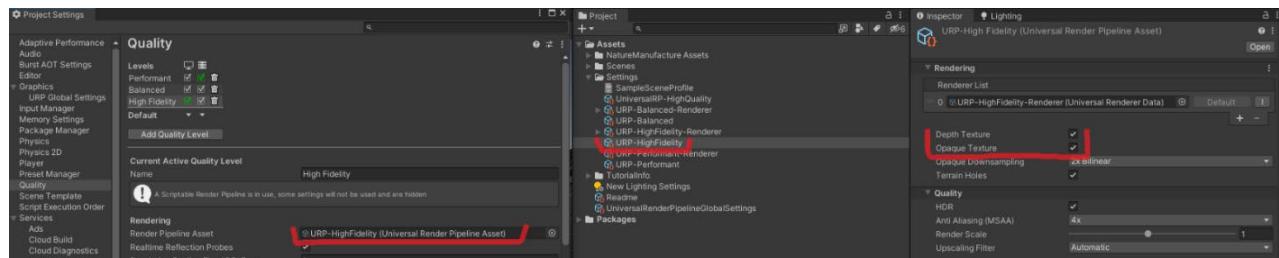
- After you import our asset to your URP project you have to import the URP support pack. It contains prefabs, materials, shaders, and profiles directly for specific URP and Engine versions. You can find it in HD and URP Support Packs folder.

URP is fluid so support files from 2021.3 may not work in 2022.3. That's why we prepare files for most/each engine version.

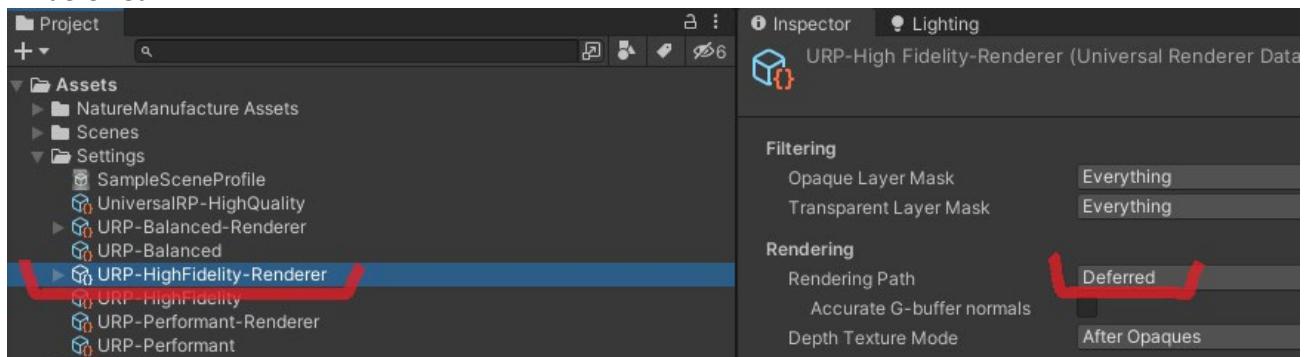
- You also have to import Visual Effect Graft if you want to use fast particles with a distortion effect



- To render properly distortion and transparent particles you have to turn on Depth and Opaque Textures checkboxes.



- Best performance you will get with Deferred render. Each reflection probe, light duplicate the number of verts at Forward render so more complex scenes should use deferred. Performance is x2 better with deferred.



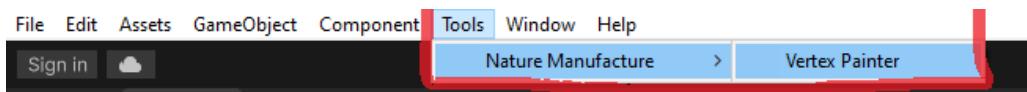
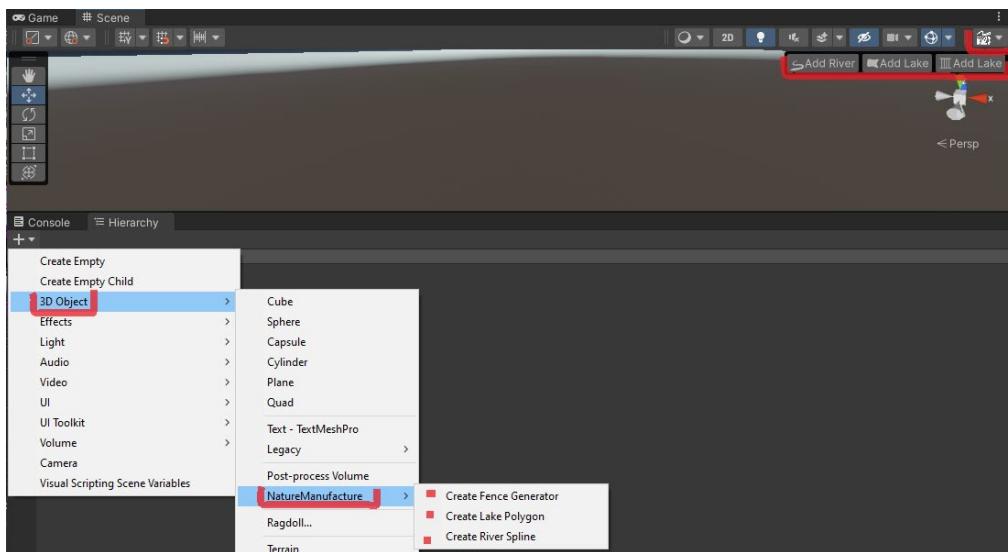
- Notice that URP is changing all the time and these options may migrate from place to place in different engine versions.



Tools Overview

L.V.E 2023 and R.A.M 2023 contain a few main tools and aspects.

1. **Splines:** Tools to create rivers, roads, and cliffs. It may carve and paint terrains. With flow-map and vertex color tools you can customize every shape. You can snap it to every object and take normal from it so you can blend surface with unity terrain.
2. **Lakes:** Tools to create lakes, endless seas, and big closed shapes. It may carve and paint terrains, and generate, with flow-map and vertex color tools you can customize every shape. You can snap it to every object and take normal from it. It also can paint the whole terrain with predefined rules like we did in the video.
3. **Fence:** Tool that spawns objects with probability. It may bend and modify 3d meshes. It co-ops with splines so it's perfect to create side road objects as well. It also may be used to create curved complex stair objects curved by splines.
4. **Vertex painter:** Tool which allows painting flow-map and vertex color on 3d meshes **but not** splines and lakes.
5. **Shades's** environment to support lava and river complex features like automatic rock heating or terrain blending.
6. **Particles:** Advanced particle library to create an immersive lava environment. HD and URP also start to use VFX to achieve the best performance.



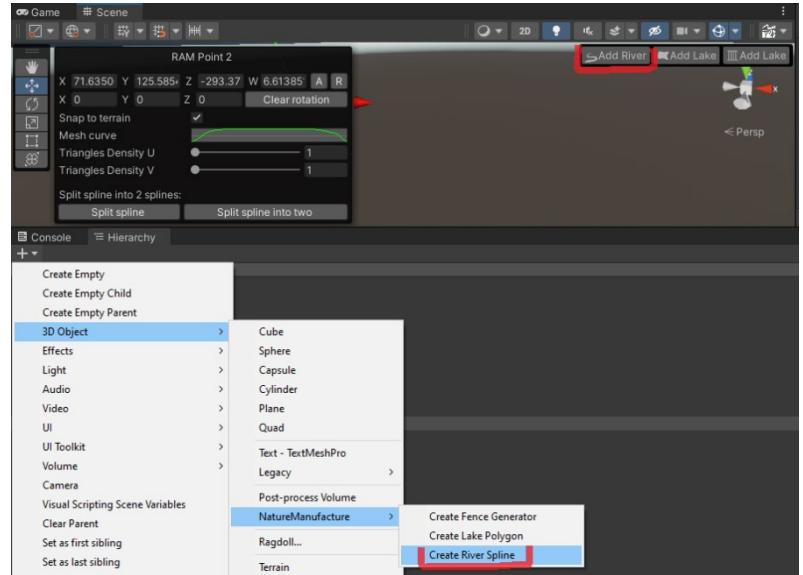
Spline System

1. Create spline.

You can create our spline object in 2 ways:

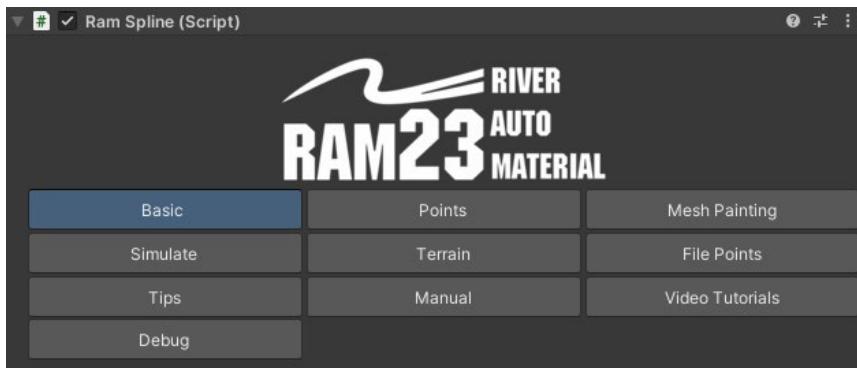
- Scene window panel “**Add River**” button
- Hierarchy “+” panel by choosing **3d Object -> NatureManufacture -> Create River Spline**.

With our spline tool, you could create a very advanced mesh for your water/lava river or cliff and road. Tools inside the spline system allow you to manage a huge amount of mesh aspects.



2. River spline panel.

If you check the spline in your hierarchy you will get such a view.



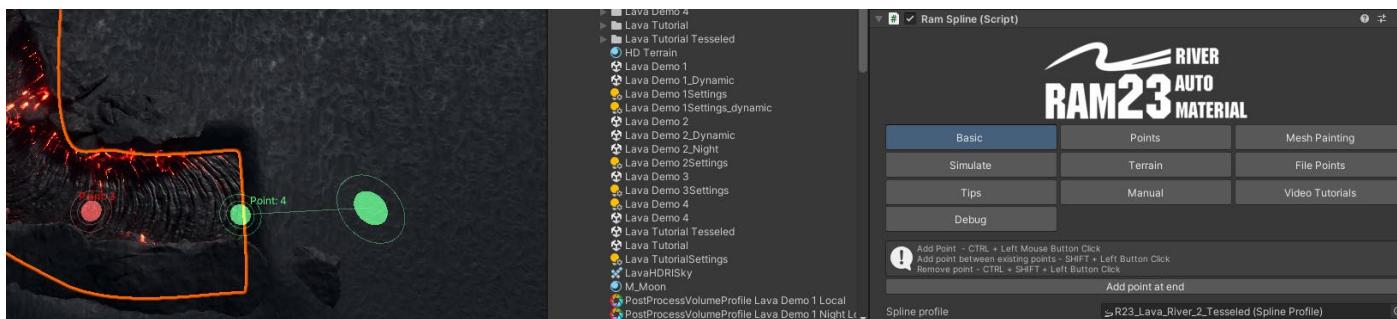
As you see there are a few main pages:

- “**Basic**” - changes which are global for the whole mesh or even a few of them if rivers are connected. You could manage here uv, vertex density and shape, light setup, normals, snaping, river connections
- “**Points**” - local changes like rotation, position, scale, add, remove, select, snap, local mesh shape
- “**Mesh Painting**” - modify mesh and customize locally by our vertex color tool, flow-map.
- “**Simulate**” – this part allows you to simulate river/spline flow from a specific point. The system analyzes terrain and gives the result of the future river.
- “**Terrain**” – modify terrain under the spline like paint, carving, and foliage management.
- “**File Points**” – here you could import/export points from a CSV file to create R.A.M spline.
- “**Tips**” - info about lighting and tricks.
- “**Manual**” - which drives you directly to this PDF
- “**Video Tutorials**” - which will open YT tutorials where we will explain R.A.M and L.V.E usage.
- “**Vegetation Studio Pro or Non-pro**” – it shows only if the vegetation studio is inside the project and gives the ability to manage foliage in co-op with that system.

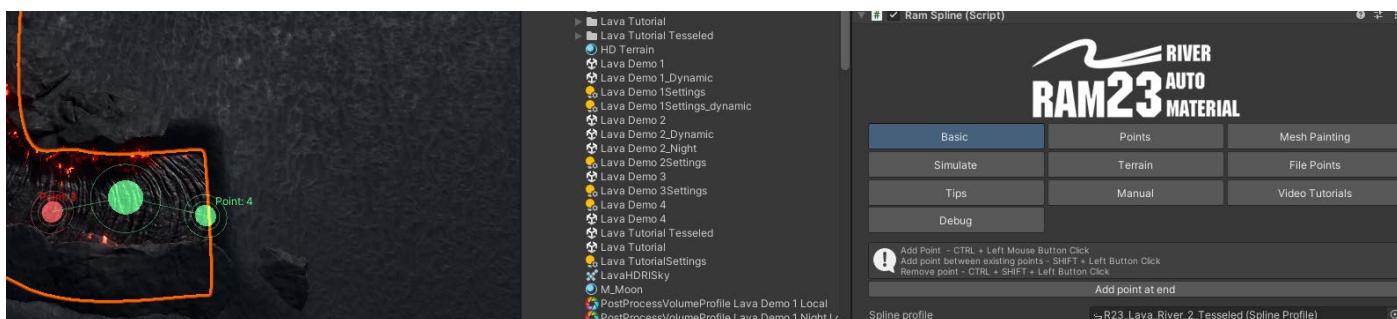


3. Add points / remove points (ray cast from mouse)

- Add new points when you hold: **CTRL + Left Mouse**. Set up a few points like that.
- Add point between existing points: **Shift then Left Button Click** (shows debug lines which follow the pointer)

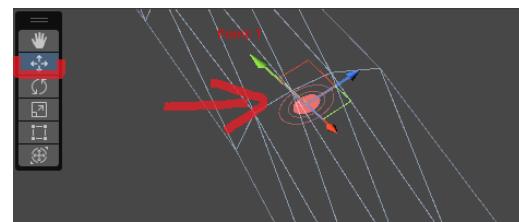


- Remove point: **CTRL + Shift** then Left Button Click to remove point. (shows debug which fallow the pointer)



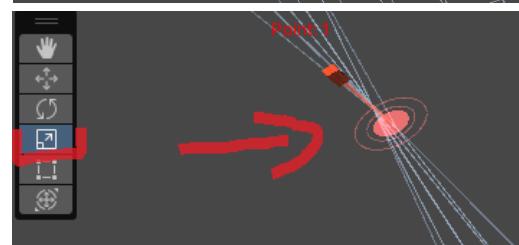
4. Move points.

You could start moving your river in a specific point by clicking "W" or by this marked button.



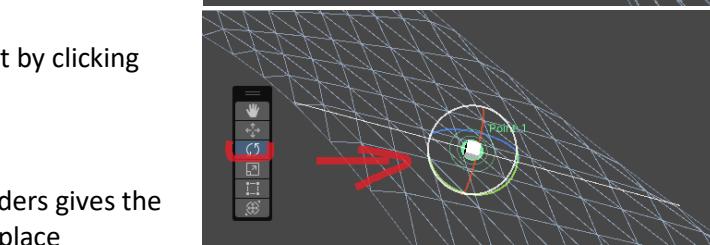
5. Scale river (per point)

You could start scaling your river at a specific point by clicking "R" or by this marked button. During moving the box up or down on your screen, the river will get a different scale at selected points.



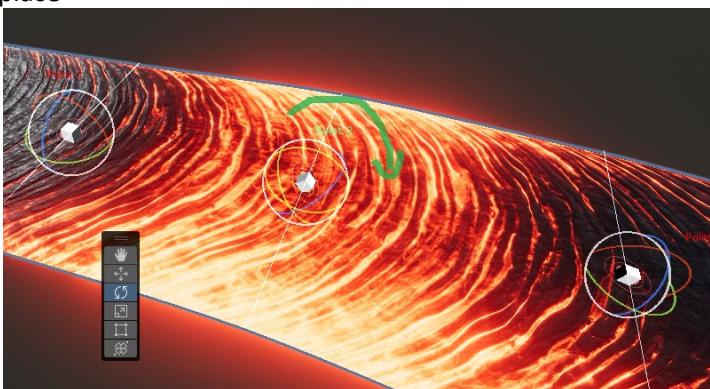
6. Rotate river (per point)

You could start rotating your river at a specific point by clicking "E" or by this marked button.



Rotating in the "X" direction (red line) with our shaders gives the additional effect of creating waterfalls in a specific place

It's because shaders read the vertex normal of the mesh and if we add even a fake slope (rotate normal) it generates a waterfall effect out of the box.

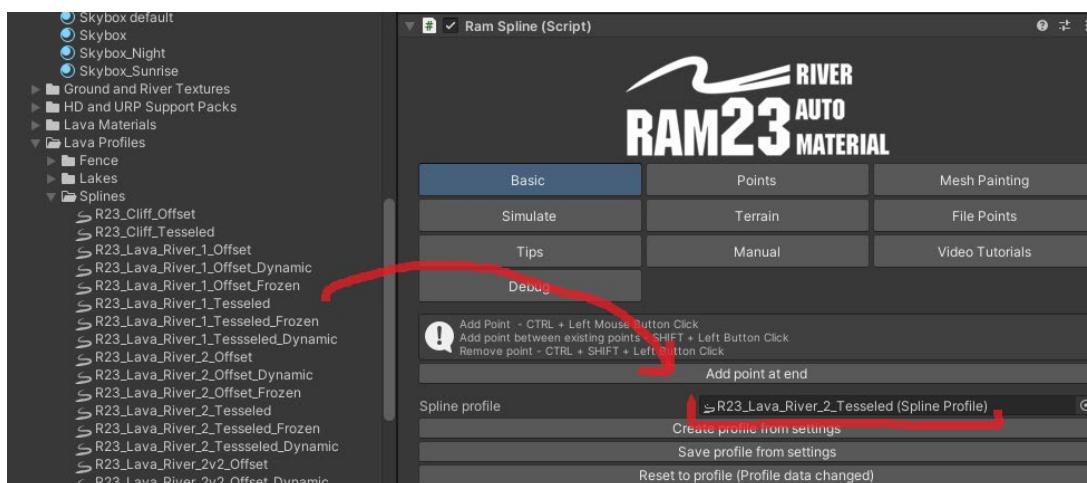


7. Profiles - set up material or whole river features

There are 2 ways to set up material into spline.

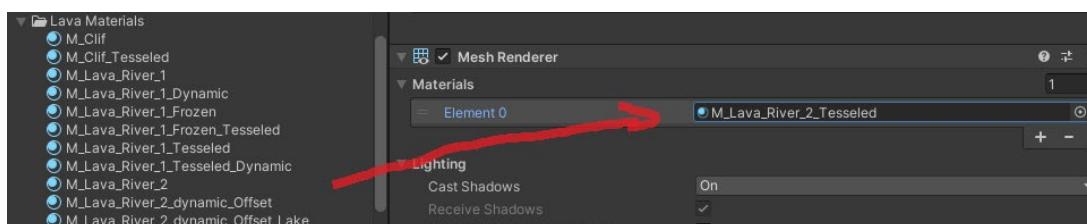
- You could drag and drop profiles that we prepared which contain info about:
 - material
 - mesh shape
 - UV directions and density
 - spline /mesh resolution
 - terrain carve
 - terrain painting
 - flow map
 - shape and flow map noises,
 - vegetation studio pro biomes
 - light setup

The whole river setup is out of the box – drag and drop setup. It's very useful, you don't have to copy-paste any values anymore to create similar effects. Make note that we mark our profiles for R.A.M 2023 as R23_“Name” to avoid problems with older system versions.



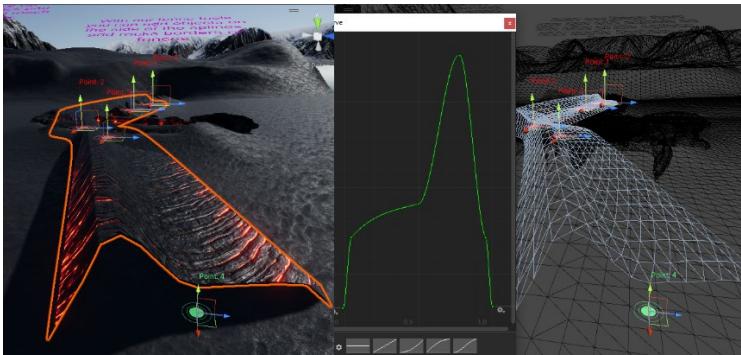
In our many assets like the meadow environment where we use R.A.M splines to create roads or rivers for demo scenes, we always include profile files so you could simply drag and drop it and use it in your scenes without additional setup.

- You could drag and drop material from our library or create your spline setup from scratch and at the end save it as a profile. Just drag and drop material from a project into a mesh renderer component at a spline object

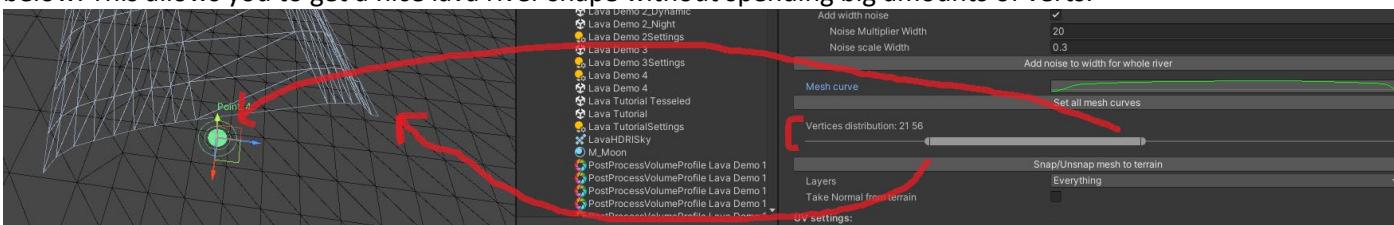


8. Basic Options

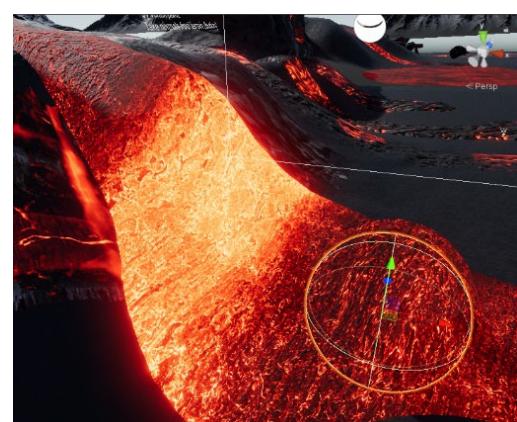
- Add point at the end:** It adds a point at the end of the spline.
- Spline profile:** You can drag and drop spline profiles to change the whole river look/variant in 1 click.
- Create, Save, Reset** to profile allows you to manage spline, save or revert changes made locally in spline object.
- Mesh settings:** U and V values are used to increase the number of verts between points (U) or spline left-right borders (V). Make note that real-time flow objects need more verts than typical spline to keep a nice shape in the front of the river.
- River width** in unity units changes the entire spline width.
- You can add basic **noise** via checkbox so the river will not look so generic out of the box. You can click it multiple times.
- The mesh curve** changes the entire river mesh shape in a perpendicular direction to the spline. Curve 0 is the side of the spline while is 1 the opposite side. To apply changes click set all mesh curves. It overwrites the mesh shape on every spline point.

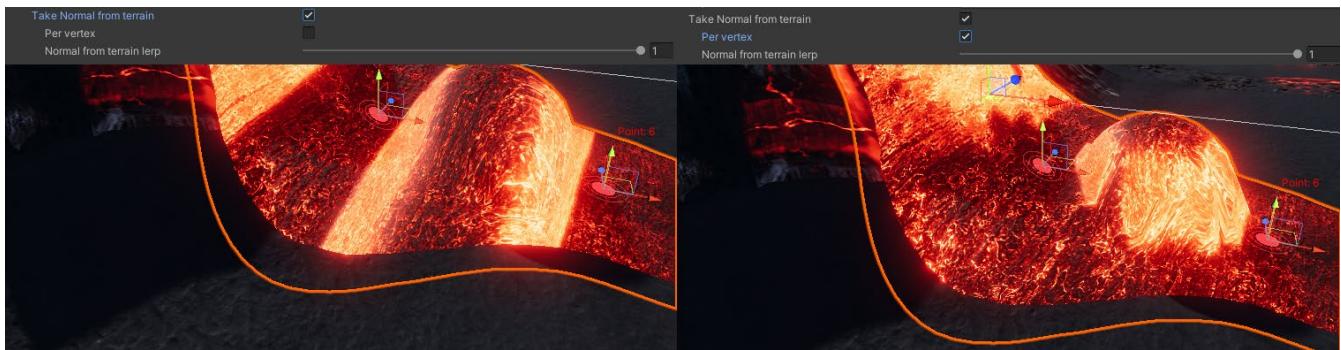


- Vert distribution:** This slider allows modification of how verts are distributed over the spline. You could hold dense mesh on spline borders or specific borders while on the rest you will get lower density. Look at the image below. This allows you to get a nice lava river shape without spending big amounts of verts.

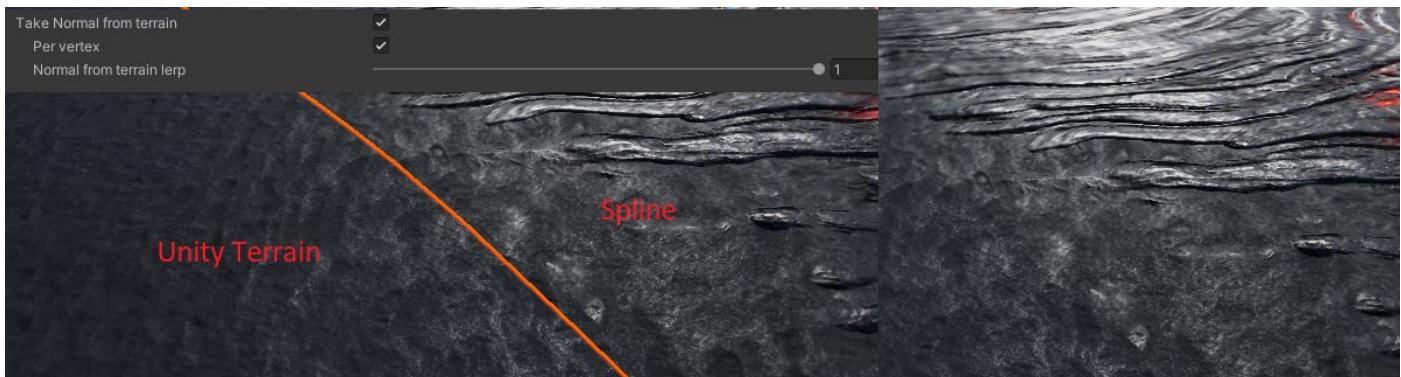


- Layers** are used to set layers for collision detection under river spline, for snapping, carving, and painting.
- Snap/Unsnap mesh to terrain** allows to snap spline mesh to unity terrain, or any other colliders. For example, the sphere is like in this image. Just chose a layer with collider and spline will refresh the verts position and snap them to the surface.
- Spline also can **take normals** from that surface. Per point or vert.
 - Per point option (default) will generate lines with the specific normal direction taken from the middle of the spline.
 - Per vertex will take normals from the shape under the spline each vertex separately.
 - The slider allows to management power of this normal, reduce, blend influence surface under the spline.



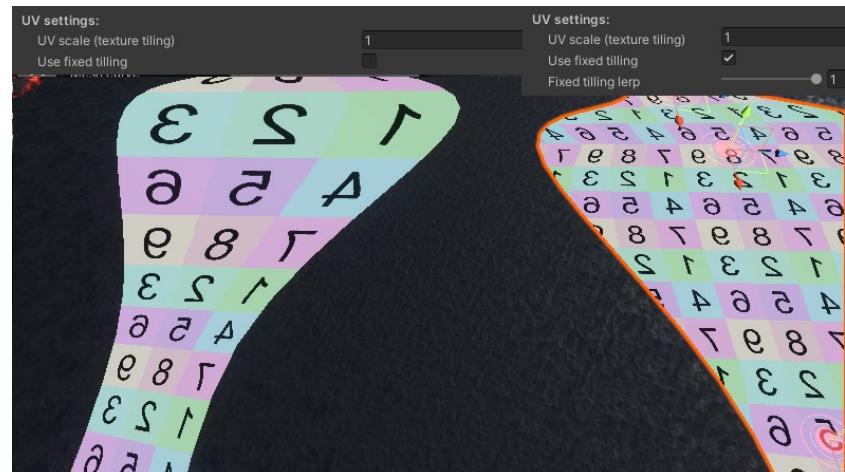


This is a powerful option because it helps to blend spline 1:1 with unity terrain as long terrain and spline texture in that place is the same with similar UV position. It's possible with our shaders for frozen splines and normal 3d objects.

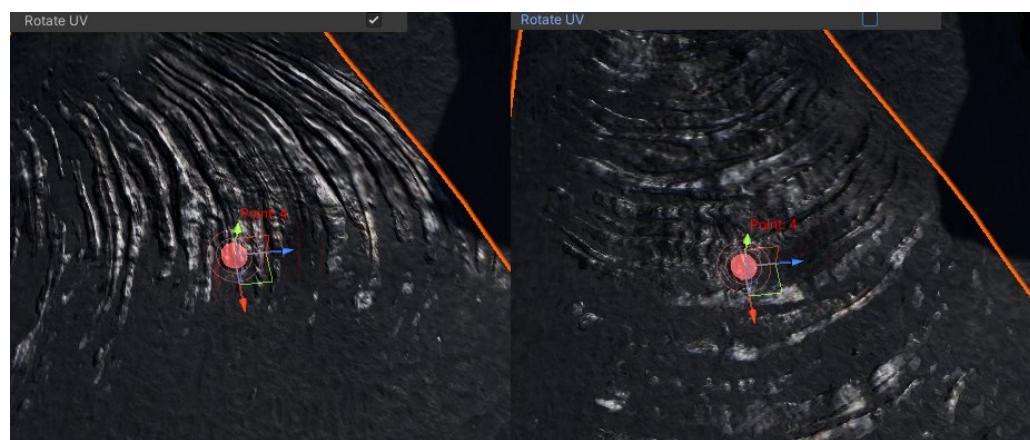


- **UV settings** help you to manage splines UV in different situations and inputs.

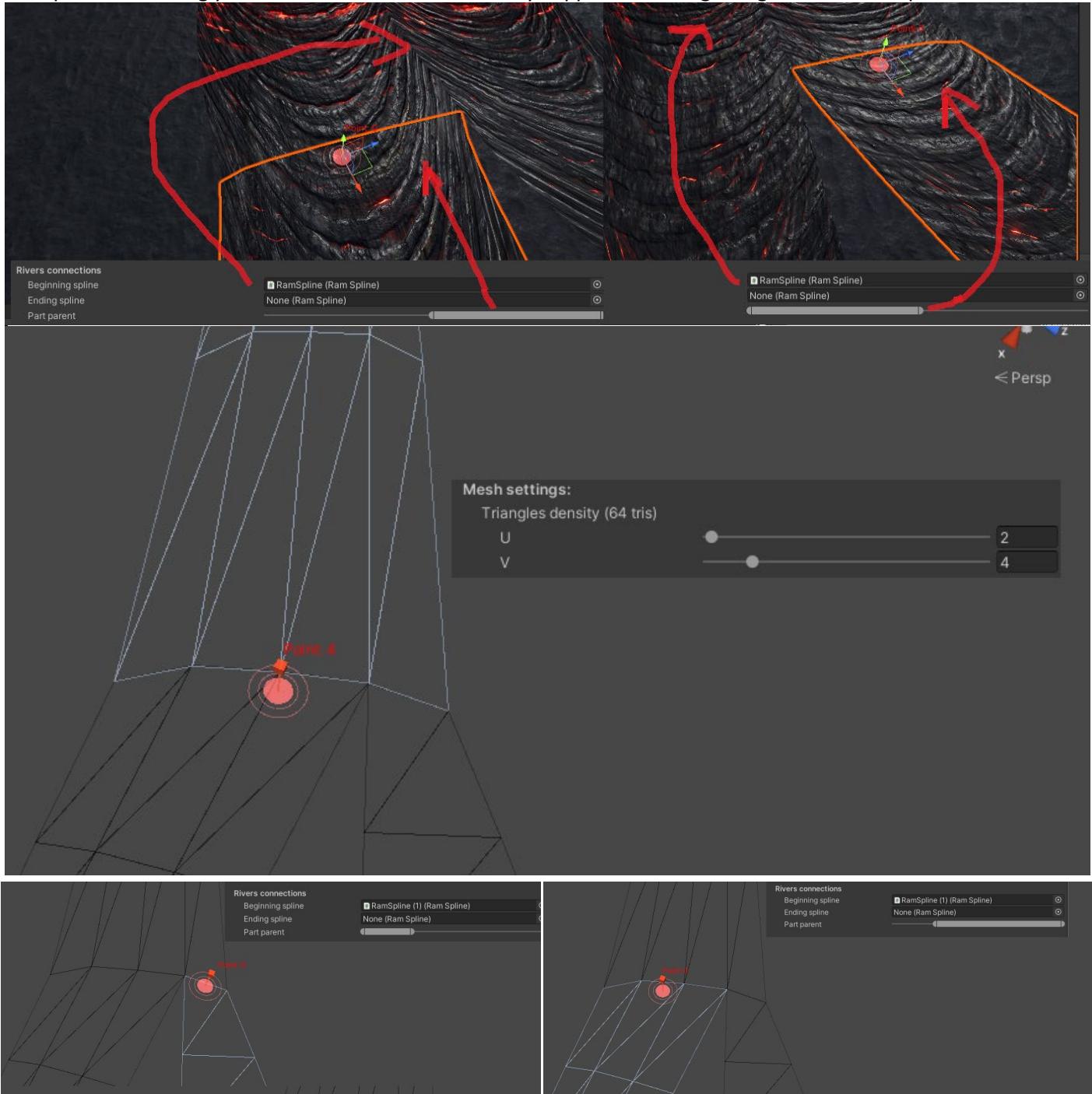
- **UV scale** change tiling on spline surface
- **Use fixed tiling** block tiling on the river surface even if the river becomes scaled. It means it behaves a bit like UV-free material but with a spline direction. It's more useful for paths, water rivers, and tiled shapes that don't look good with scaled UV. Make note it breaks the connection between 2 splines because each spline has a different UV so it prevents splines from seamless 1:1 connections.
- With the slider, you can manage the power of fixed tiling effect



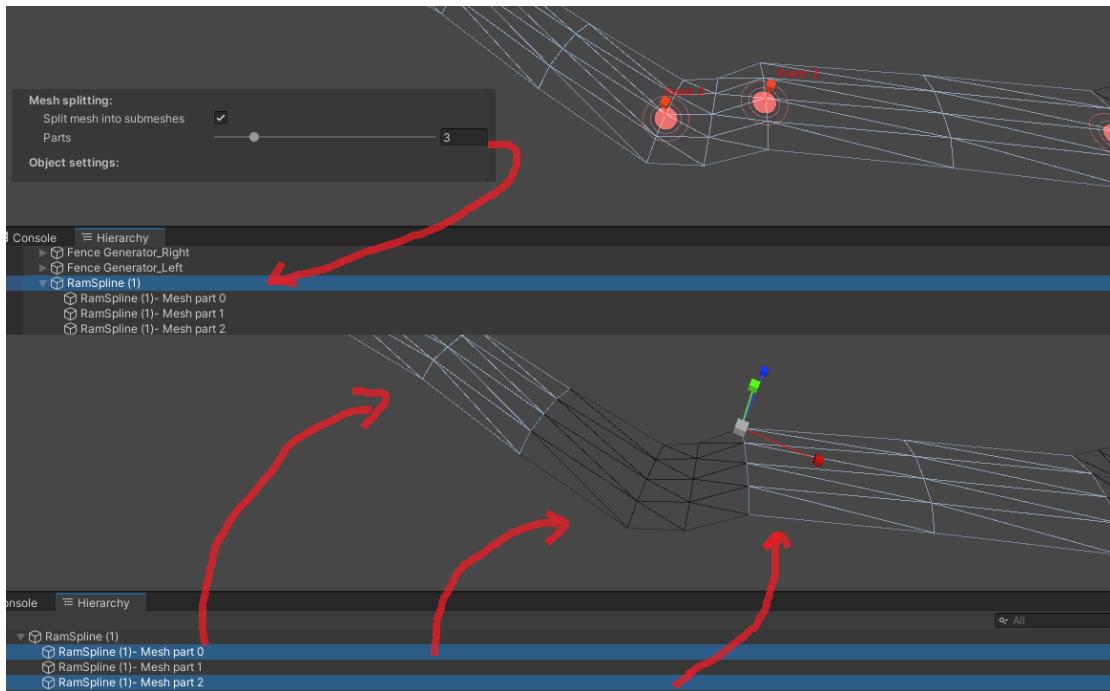
- **Invert and rotating UV** allows you to change the UV direction of the spline. Useful when you use textures with specific direction



- **Lightning settings** manage basic options of the mesh like receive or cast shadows or not.
- **Rivers connection** allows connecting rivers by setting them their beginning or ending - other splines existing at the scene. When you drag and drop the spline object you specify how much V amount of V verts via slider you want to spend on this connection. It's because you can connect as many rivers as many you got V verts resolution. It manages how many V verts will new river have. You can disconnect and connect rivers like that multiple times as long you have V verts resolution. It may happen at the beginning or end of the spline.



- **Splitting mesh into sub meshes** help to avoid problems when a single spline mesh is too huge or you want to avoid 1 big river mesh across the whole scene for example for culling purposes. It split the generated mesh into smaller defined parts while spline it's still one object.

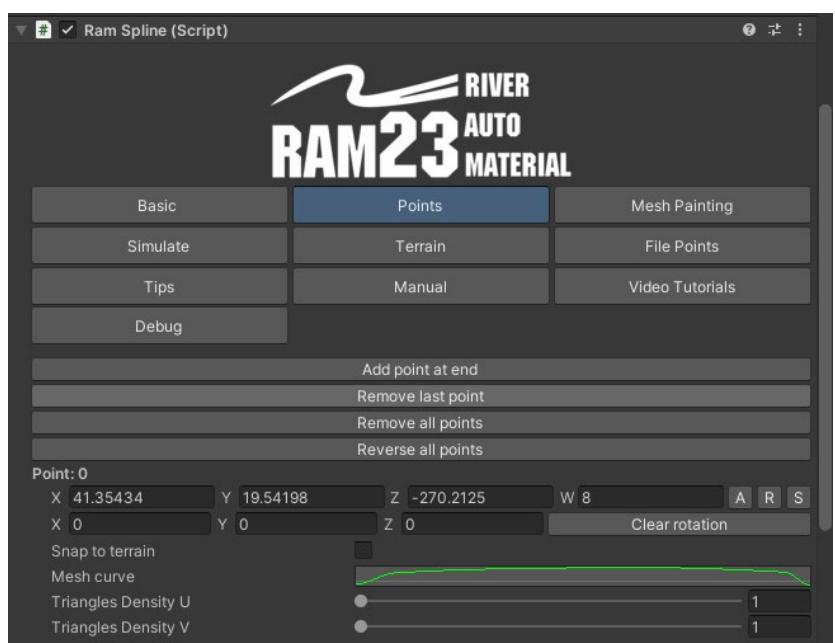


- **Objects settings** give you the ability:
 - change objects pivot to the center or specific position typed in XYZ windows,
 - regenerate (rebuild) spline on play mode
 - export spline into unity asset mesh.

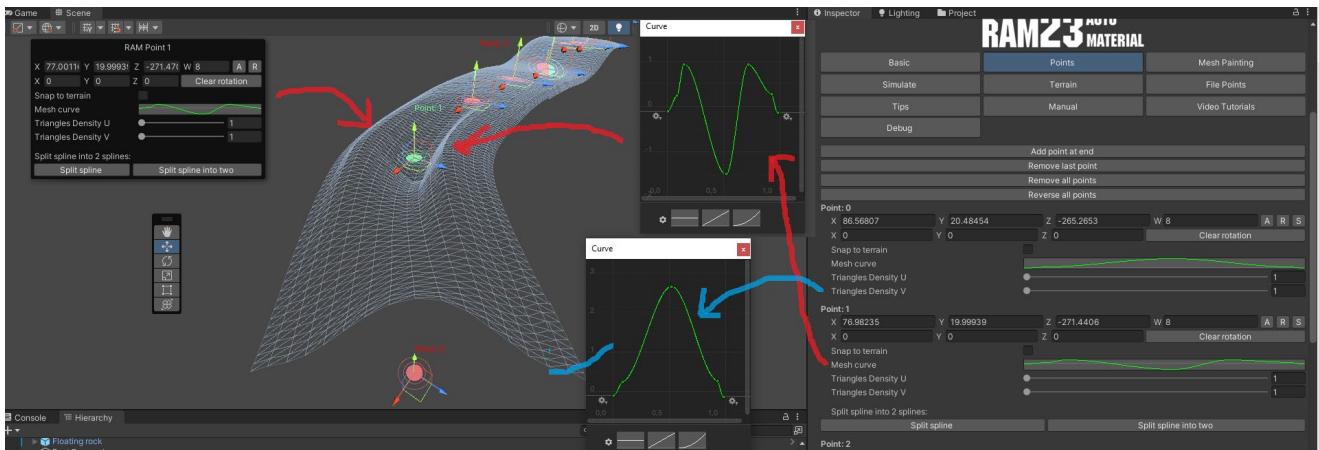
9. Points Options

In the points section you can manage the mesh shape at each point separately, add, remove points, change, or clear rotation.

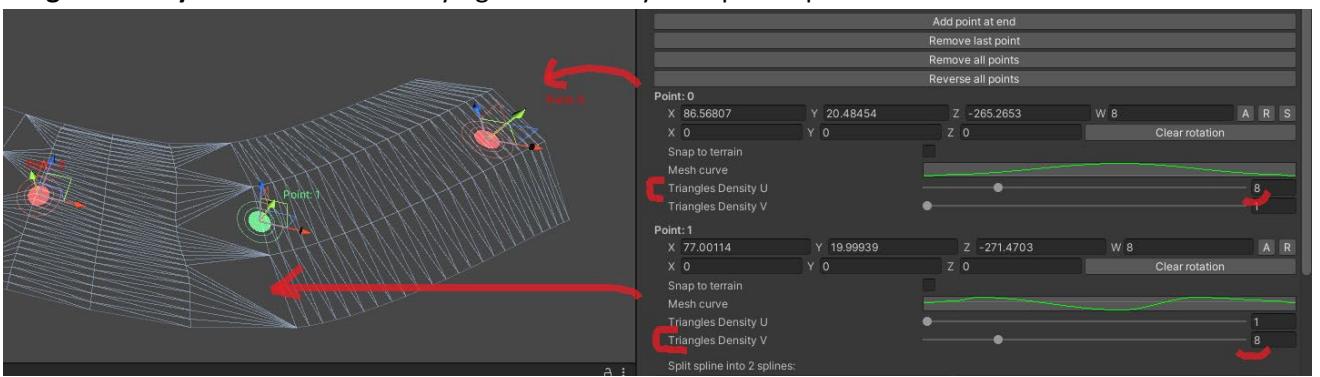
- **Add point at the end** - it adds a point at the end of the spline, it uses scale, rotation, and shape from a point before.
- **Remove the last point** – it removes the last point at the spline
- **Remove all points** – it removes all points from the spline
- **Reverse all points** – it changes points' order so the point will become at the actual end of the spline while the last point becomes the spline start.
- Each point has XYZ position and rotation and "W" which is a scale of the spline in this specific place
- **Snap to terrain** - allows to snap/unsnap mesh in just this specific place, locally.



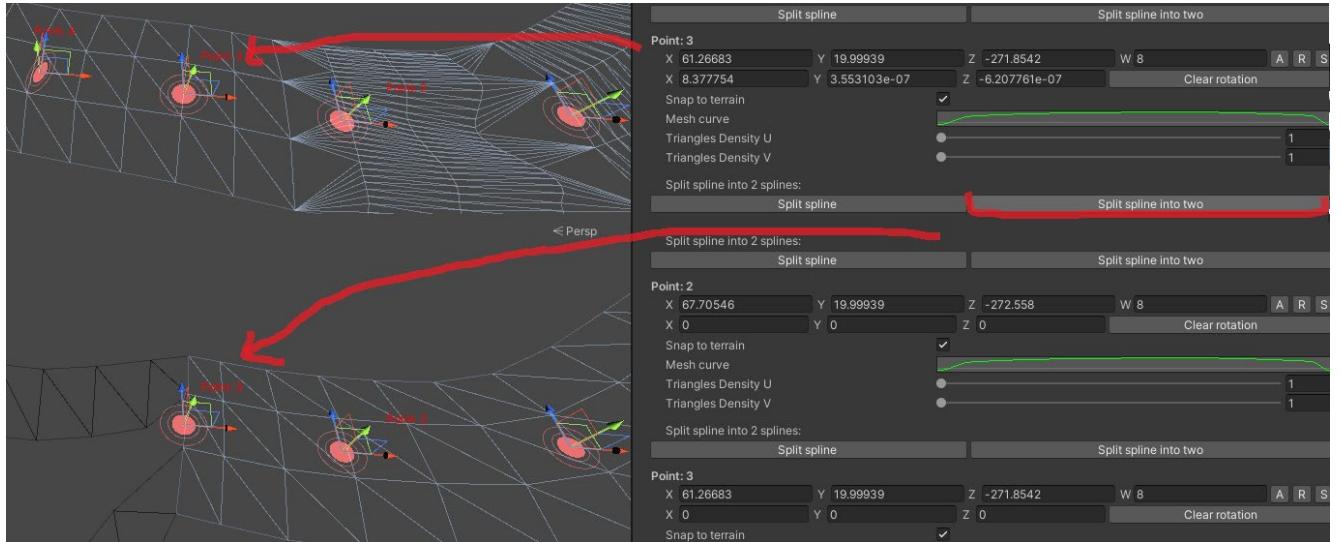
- **Mesh curve** - allows changing mesh shape just in this specific place. After you select a point you will have the same point window set up on the left



- **Triangles density U and V** allow modifying mesh density in a specific point.



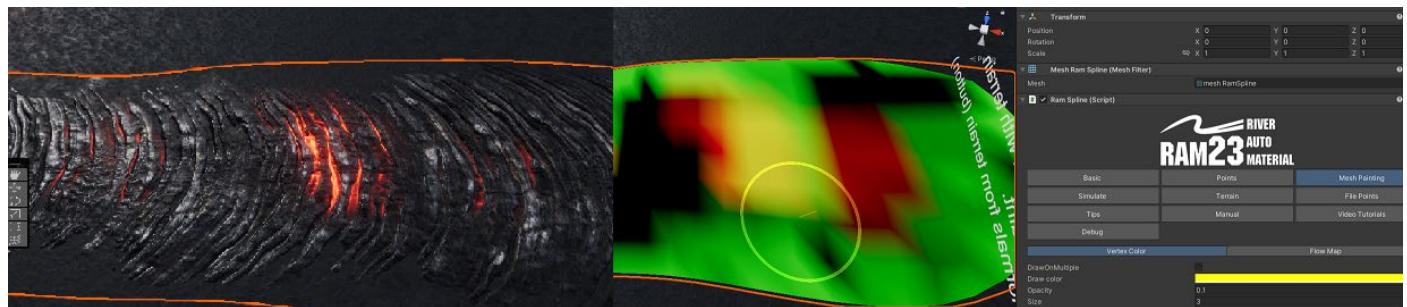
- **Split spline** – just split the spline object into 2 spline objects – they become automatically connected.
- **Split spline into two** – it splits spline into a “fork” at a specific point. It creates 2 splines in a dedicated point which are connected to the old spline in chosen point.



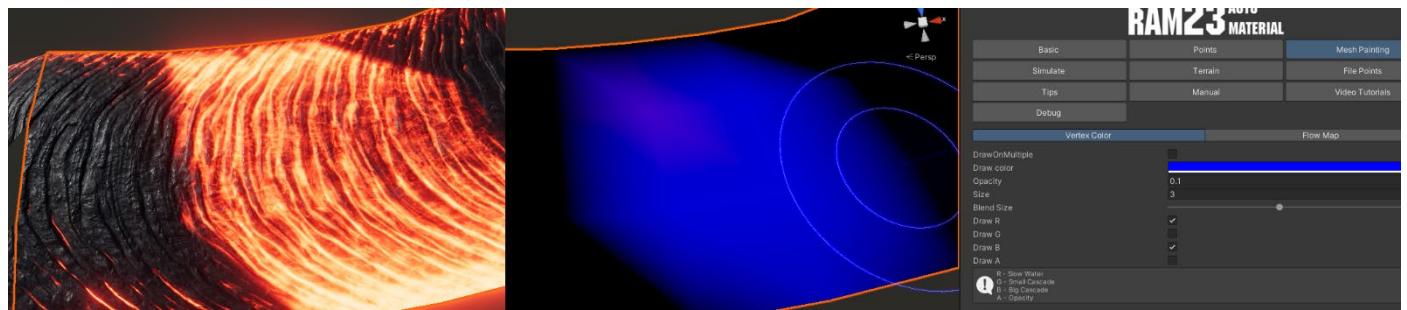
10. Mesh Painting

This part allows vertex paint spline mesh. You can vertex color triangles and paint values on UV (flow map)

- **Vertex Color:** This release effects related and based on vertex color if the shader supports it.
 - In frozen lava shader vertex color heat surface (R) or cover by 2nd layer like sand (G)



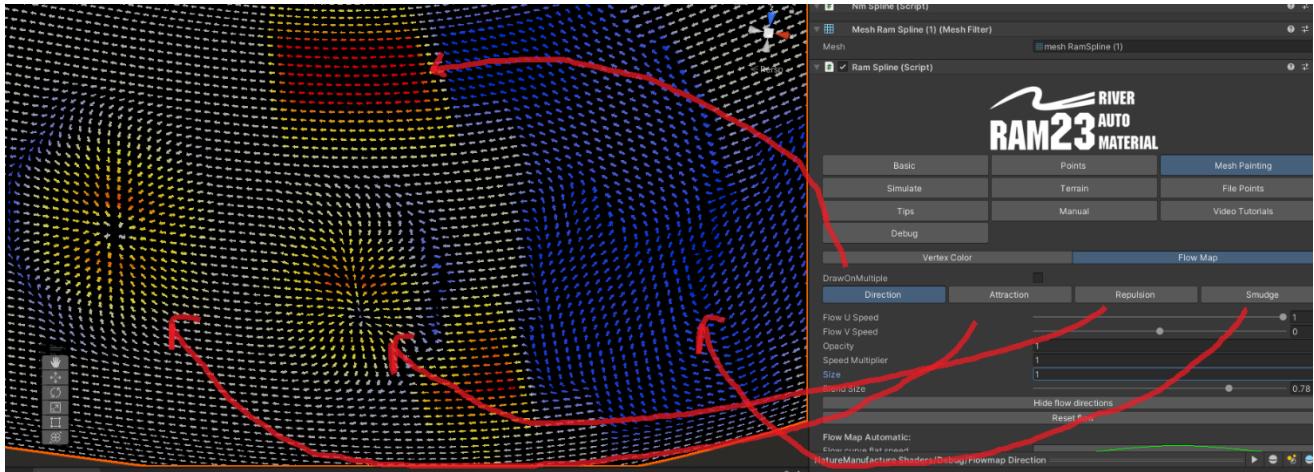
- In the lava river, this change waterfall/lava stages (R) cold, (G) medium, (B) hot, (A) can multiply emission in material, so make place hot or cold.



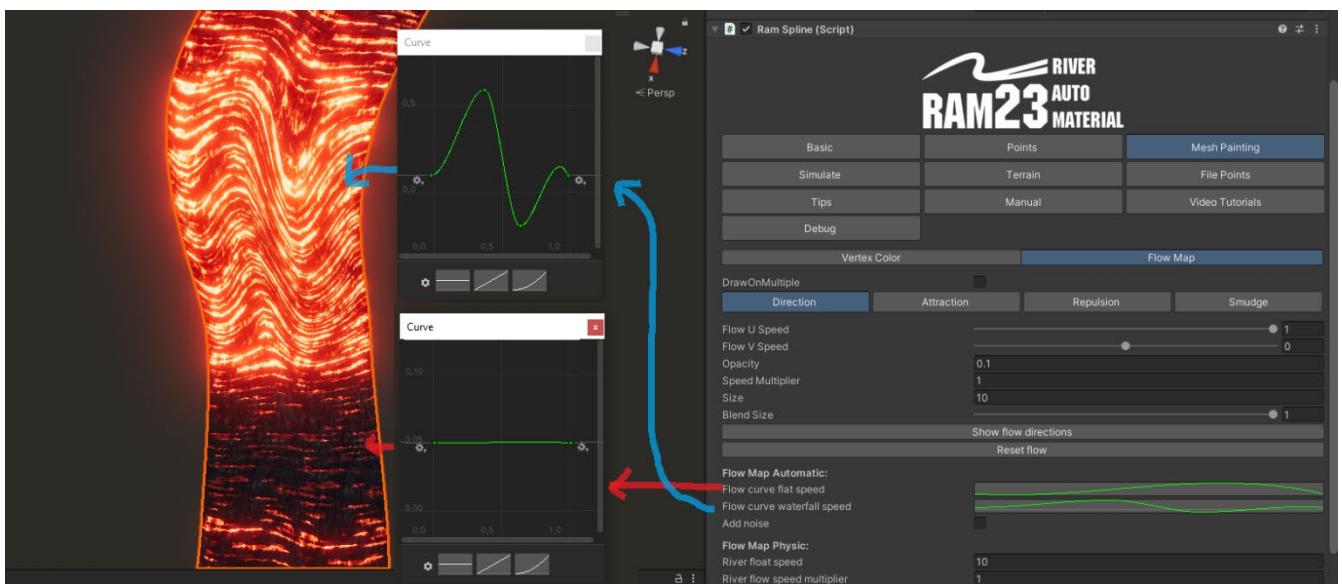
- **DrawOnMultiple** allow you to use the same brush on multiple rivers, it help in moment when you paint connected rivers.
- **Opacity** is responsible for the power of the brush
- **Blend size** is responsible for the softness of the brush
- **Checkboxes RGBA** allows excluding color from painting.
- The default river color is black



- **Flow Map tool** is painting values on UV, our shaders read UV to get information about lava direction and speed. We advise **painting soft flow-map changes** to avoid artifacts on the lava surface. Too big a speed change will stretch lava, while too big a slowdown will tighten it. Red color means fast flow while blue means that movement is slow. There are a few painting options.
 - **Direction** - you setup U and V speeds and paint specific directions on the surface
 - **Attraction** creates a place where lava moves like into funnel so from outside to inside that place
 - **Repulsion** is opposite to attraction, lava flows outside from this place.
 - **Smudge** – lava will follow the brush, its direction, and speed. The faster you will move your mouse, the faster the flow map you will archive.
 - **Show/Hide** debug mode open and close debug mode below.



- **Reset flow** will reset flow-map to automatic values which you can set up in the automatic flow-map section.
- Flow Map automatically allows managing the default flow map on the spline surface. You have 2 curves here
 - **Flat speed** which is responsible for flow map at low slopes
 - **Waterfall speed** which is responsible for vertical surfaces and big slopes
 - **Noise** – you can specify the strength and tiling of the noise on the river surface. It helps to randomize a bit bigger rivers.



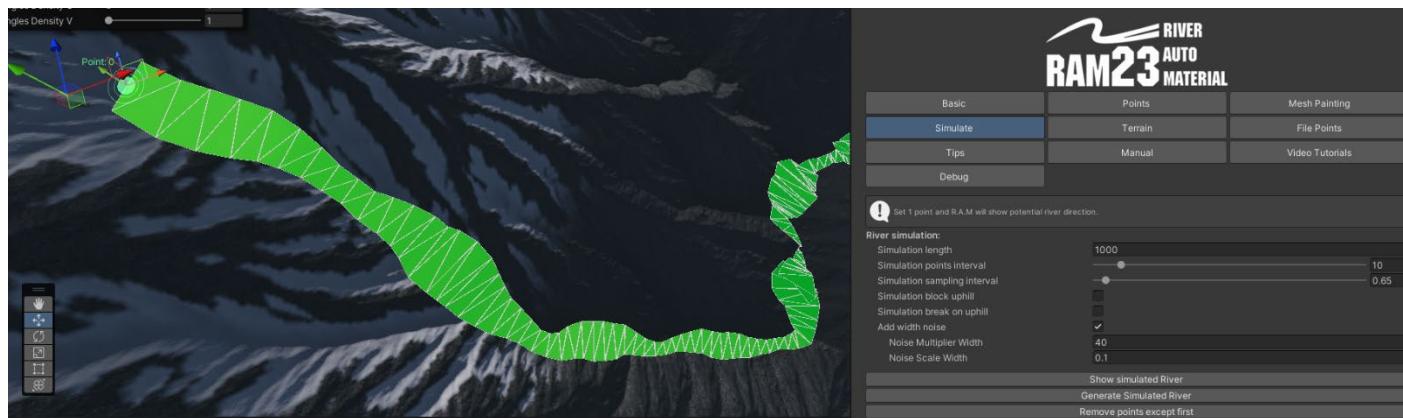
- **Flow Map Physics** - is used to set up a relation between the flow map and the physical force that push/moves objects on the spline surface.



11. Simulate

This part is responsible for the simulation part. It means you place 1 point and generate a simulation of the river from that place. Our system will take slopes, distances, and point intervals into account and generate rivers. It's a very cool feature if you want to achieve a realistic river on an existing surface. In connection with API, you can generate rivers at runtime in your game.

- **Simulation length** – value in unity units that specify how long the simulated river should be
- **Simulation point interval** – value in unity units to specify how often and dense points on the river should be. It decides how many triangles the river will have. More points generate more triangles.
- **Simulation sampling interval** – value that specifies how often you want to check terrain shape, each point, or more/less often.
- **Simulation block uphill** – it blocks the river to go uphill during the simulation
- **Simulation break on uphill** – it breaks simulation in place when the only way forward is uphill.
- **Add width noise** – it adds noise into generated shape
- **Show simulated river** – it shows debugging of the future river shape
- **Generate simulated river** – it generates river from chosen simulation setup
- **Remove points except first** – it removes all river points beside 1st which is a source for new, future simulations. It's useful to make a few simulation iterations if the effect from generated river needs to be changed. After you clean the river you can move the point, change the setup and generate the river until you will be happy with the effect.

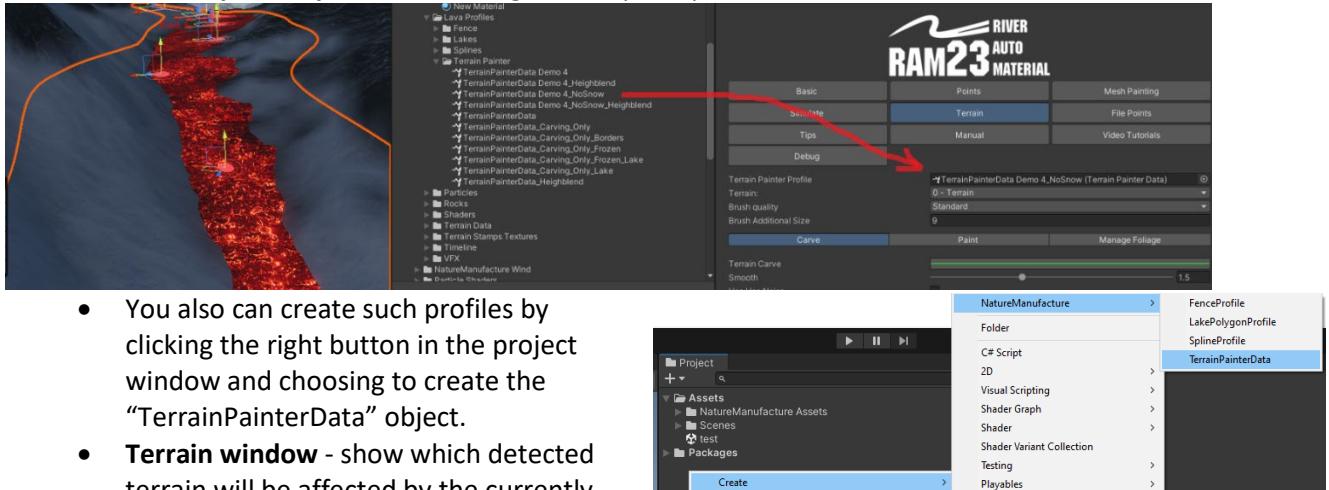


12. Terrain

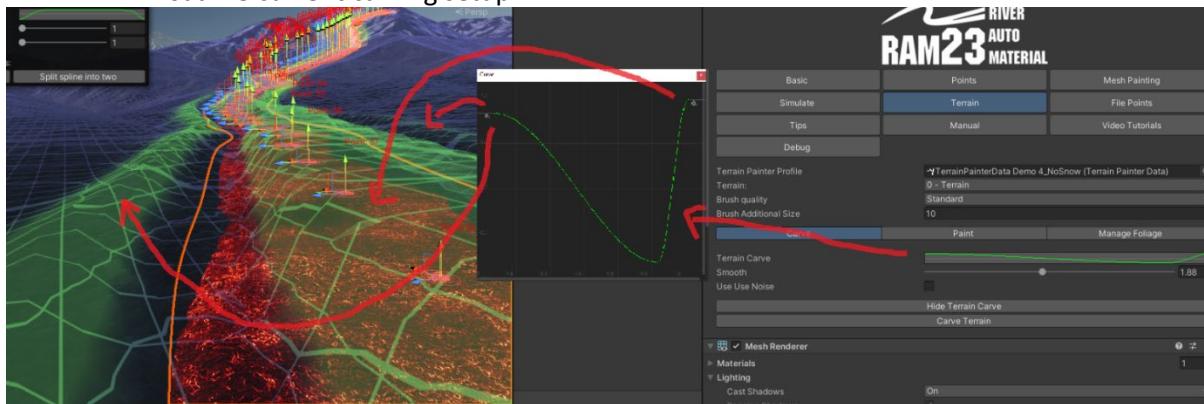
This part of the spline setup is responsible for terrain carving and painting and the foliage removal process. It's based on profiles so if you set up carving or painting for specific terrain or spline type you can use it multiple times. We prepared example profiles to show possibilities and give you an easy start with the system.

1. Carve – This part will manage the terrain carve process/riverbed shaping

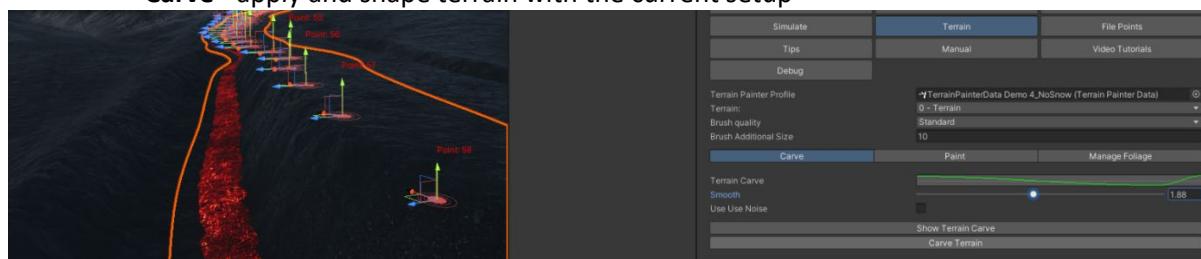
- **Terrain painter profile** - You drag and drop the profile here



- You also can create such profiles by clicking the right button in the project window and choosing to create the "TerrainPainterData" object.
- **Terrain window** - show which detected terrain will be affected by the currently chosen spline
- **Brush Quality** – it manages how precise will be the terrain carving. Higher quality is slower but the result might be much better in specific situations.
- **Brush additional size**– allow to expand spline influence on terrain during carving and painting outside the spline shape.
- **Terrain Carve** – via spline, you manage the shape of the terrain under the spline. 0 value is on spline borders while 1 is on its middle. The shape is symmetric.
- **Smooth** – this value specifies a blend between existing terrain shape and shape from the spline curve. It works outside the spline and it allows to create a nice natural blend.
- **Show/Hide terrain carve** open debug mode which renders future terrain shape. It helps to visualize current carving setup.



- **Carve** - apply and shape terrain with the current setup

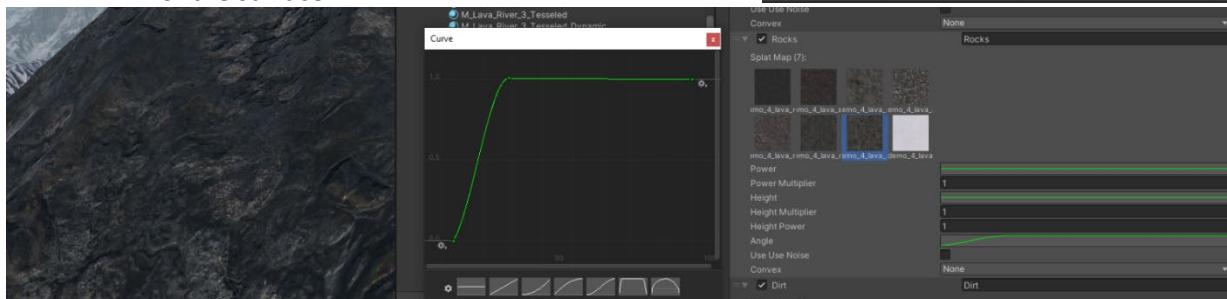
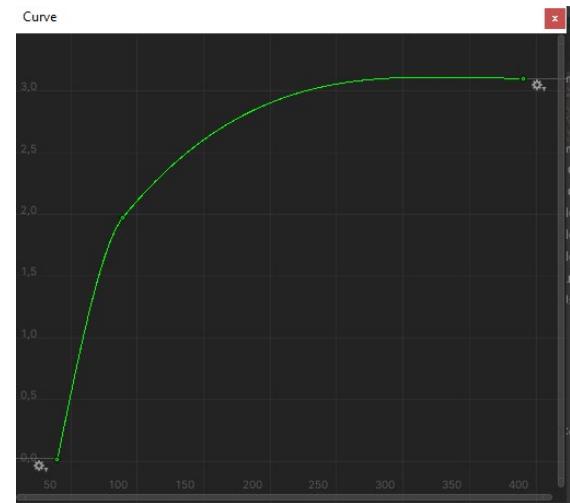


- **Use noise** - add some noise to carving inside and outside the spline so the effect will be less generic. You can set up tiling, power of the noise, etc.

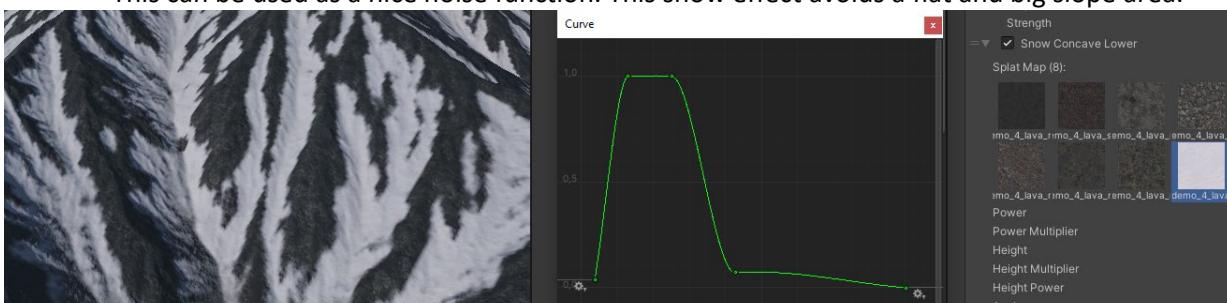


2. Paint – This part is responsible for terrain painting. It will use existing layers and definitions.

- **Splat Map** – we chose which existing splat map we want to influence without painting. Each terrain will have different splat map order but if you name effects properly you will be on the easy way to achieve nice effects without building new profiles for each terrain.
- **Power** – curve where you can multiply the power of painting inside and outside the spline. Like always 0 represents the spline border where 1 is the middle part.
- **Power Multiply** – You easily can multiply curve values without changing the spline shape. Useful if you build a definition for height-blending material and you want to use it in unity normal terrain material. You just multiply power 3-4 and you will get harder texture blending/painting which is suitable for non-height-blended materials.
- **Height** – you can manage if texture should start or stop to become painted in specific terrain height. The vertical axis is responsible for power while the horizontal is the height value. For example, the snow setup will start to become painted with Power 1 around 60-65 meters.
- **Height multiplier** – it will multiply height curve values just to improve or reduce its influence without changing its shape.
- **Angle** – it allows us to paint textures via angle. For example, we could paint rocks on bigger slopes. On the vertical axis, we have power while on the horizontal we have the angle/slope of the surface.



This can be used as a nice noise function. This snow effect avoids a flat and big slope area.

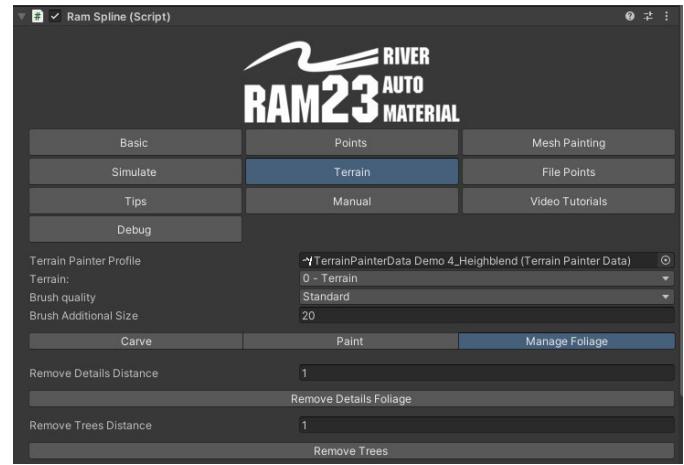


- Using **noise** will add a noise effect to the painting to avoid big same looking repeatable surfaces.
- **Convex and Concave** – these options are used to accent skeletal lines.

With the number of steps, their size, and strength we regulate hardness (steps), area (size), and multiply (strength) of concave and convex painting. It allows placing snow, rocks or sand, and grass in holes or peaks. Look at the image where snow use concave.

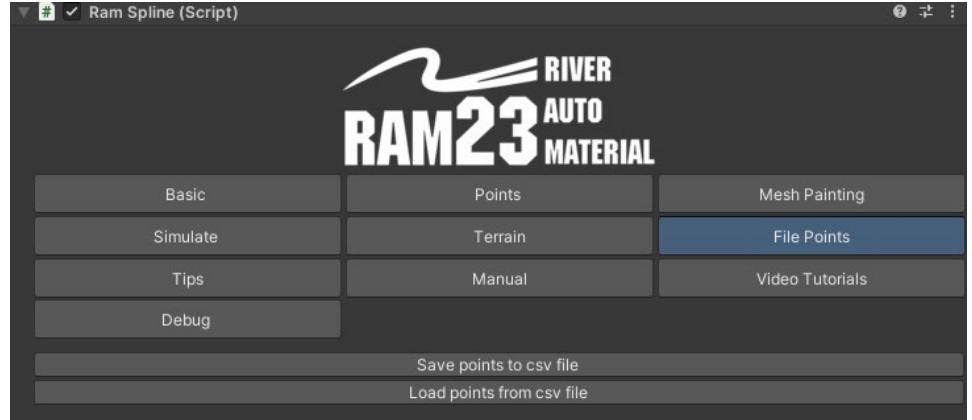


3. **Carve** – This part will manage the terrain foliage removal process. You can remove foliage objects like grass or trees from the spline shape and distance around it (buffer area). You specify separated distance for grass and trees and after you click remove spline will remove them.



13. File points.

You can import or export spline points into CSV files. It's helpful if you have a river defined from outside the unity or if you want to export a specific shape.

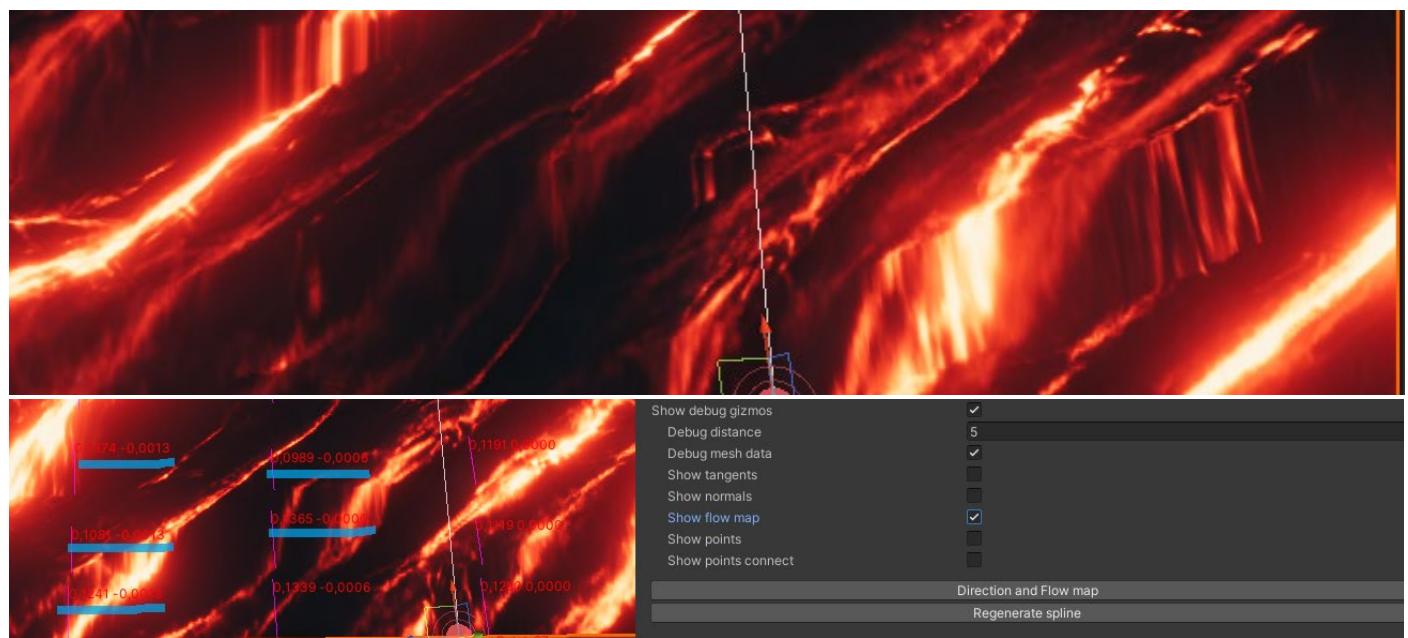


14. Debug

It is a pretty complex debug system.

You can render a gizmo with mesh shape, normal, tangents direction but also flow-map values. This help to detect issues on the spline that are hard to catch or understand without values or gizmo representation.

For example, the big jump in flow-map values from strong noise with small tilling generates stretched texture.



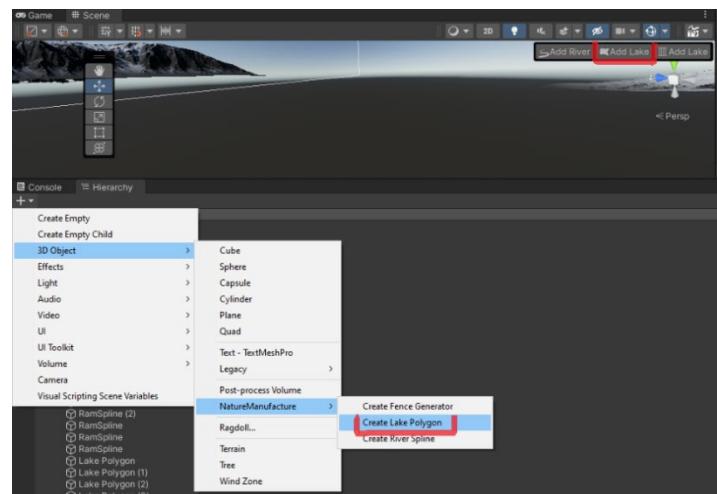
Lake System

1. Create a lake.

You can create our spline object in 2 ways:

- Scene window panel “**Add Lake**” button
- Hierarchy “+” panel by choosing **3d Object -> NatureManufacture -> Create Lake Polygon**.

With our lake tool, you could create a very advanced mesh for your water/lava lake, sea, or endless surface. Tools inside the lake system allow you to manage a huge amount of mesh aspects.

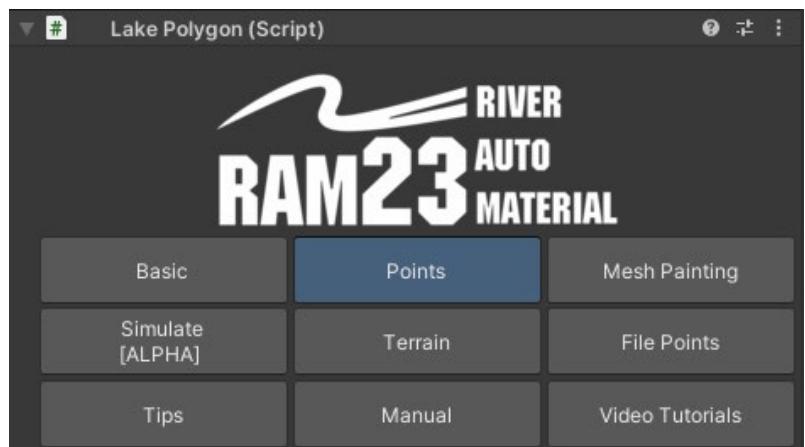


2. Lake polygon panel.

If you check the lake in your hierarchy you will get such a view.

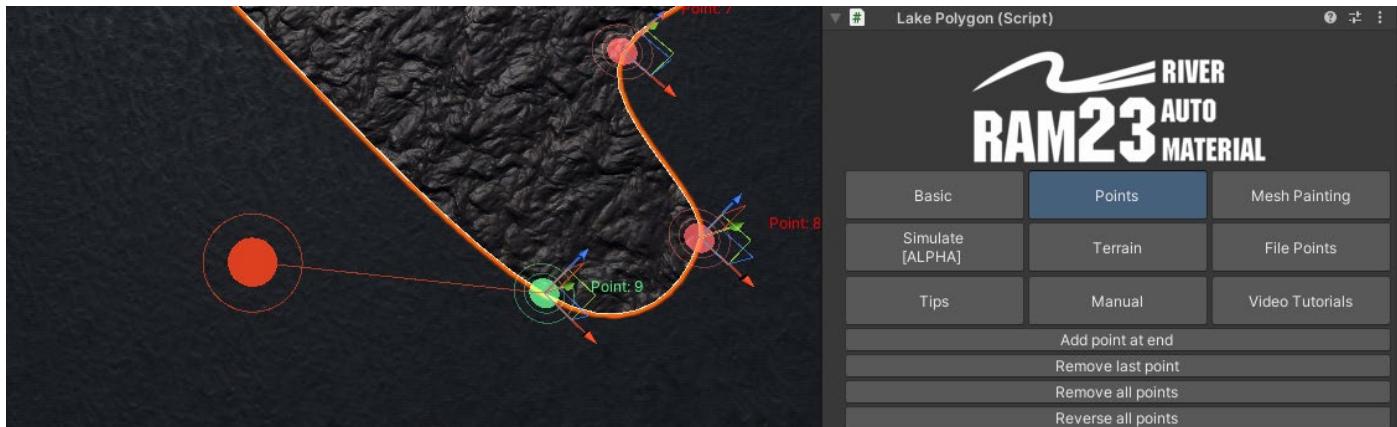
As you see there are a few main pages:

- **“Basic”** - changes which are global for the whole mesh or even a few of them if rivers are connected. You could manage here uv, vertex density and shape, light setup, normals, and snapping.
- **“Points”** - local changes like, position, local resolution
- **“Mesh Painting”** - modify mesh and customize locally by our vertex color tool, flow-map.
- **“Simulate”** – this part allows you to simulate a lake at a specific point. The lake system will fill the gap in the terrain and generate a lake polygon. The system analyzes terrain and gives the result of the future lake.
- **“Terrain”** – modify terrain under the spline like paint, carving, and foliage management.
- **“File Points”** – here you could import/export points from a CSV file to create R.A.M spline.
- **“Tips”** - info about lighting and tricks.
- **“Manual”** - which drives you directly to this PDF
- **“Video Tutorials”** - which will open YT tutorials where we will explain R.A.M and L.V.E usage.
- **“Vegetation Studio Pro or Non-pro”** – it shows only if the vegetation studio is inside the project and gives the ability to manage foliage in co-op with that system.

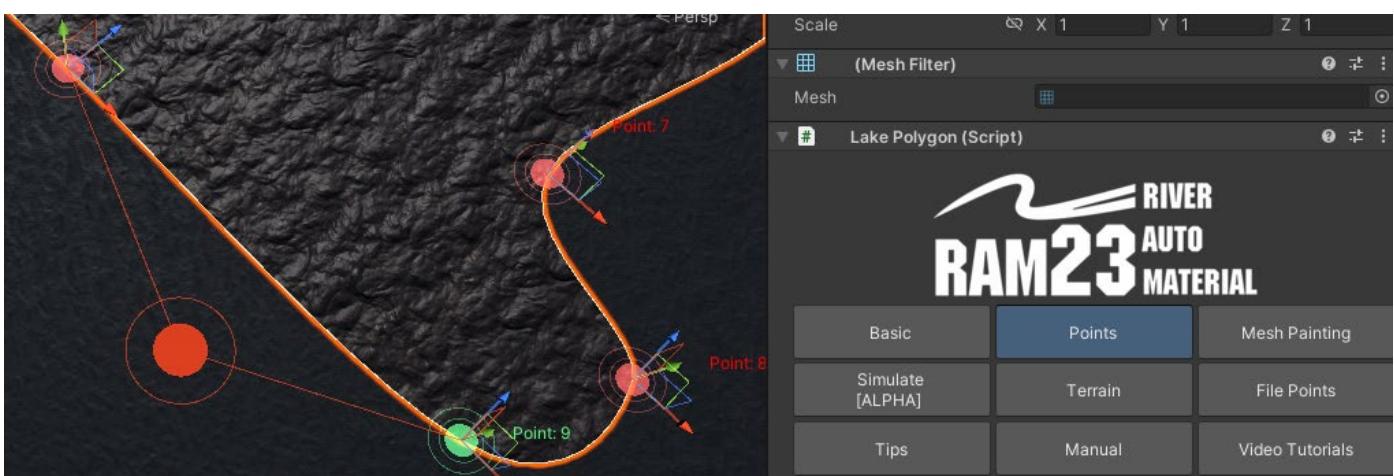


3. Add points / remove points (ray cast from mouse)

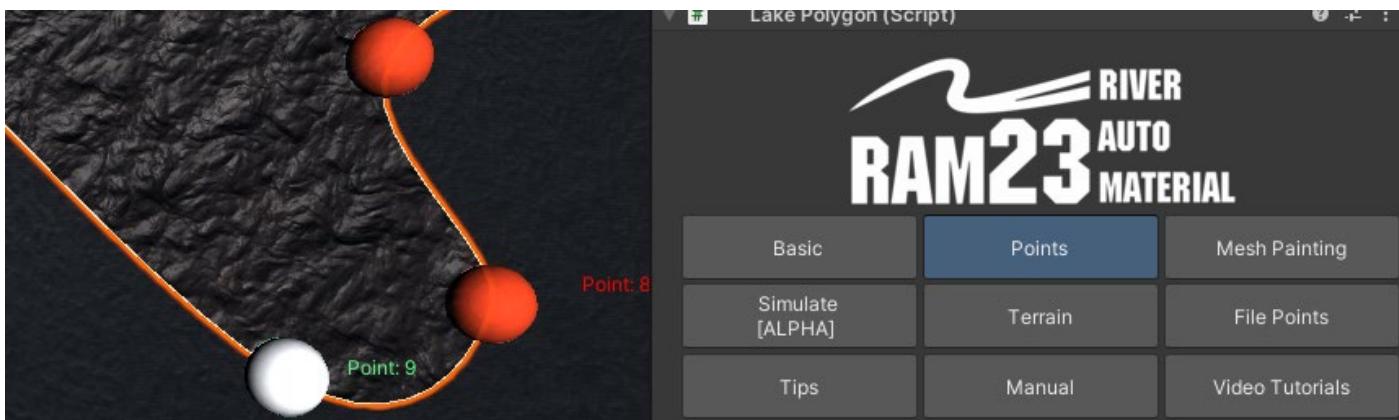
- Add new points when you hold: CTRL + Left Mouse. Set up a few points like that.



- Add point between existing points: Shift then Left Button Click (shows debug lines which follow the pointer)

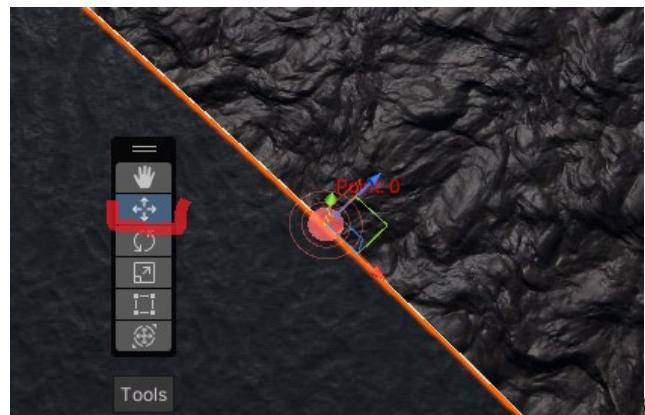


- Remove point: CTRL + Shift then Left Button Click to remove point. (shows debug which fallow the pointer)



4. Move points.

You could start moving your river to a specific point by clicking "W" or by this marked button.

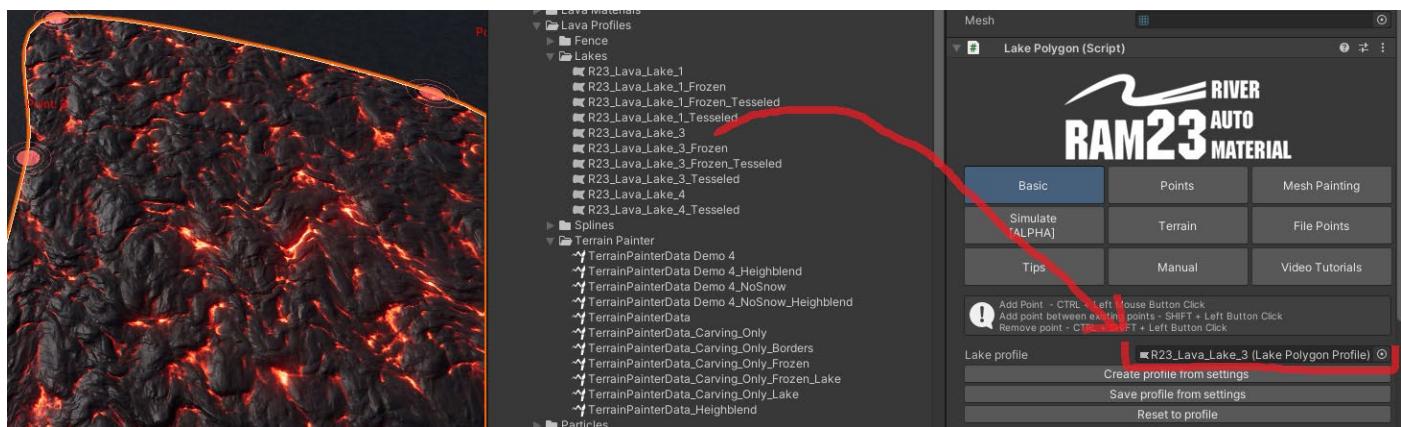


5. Profiles - set up material or whole lake features

There are 2 ways to set up material in the lake.

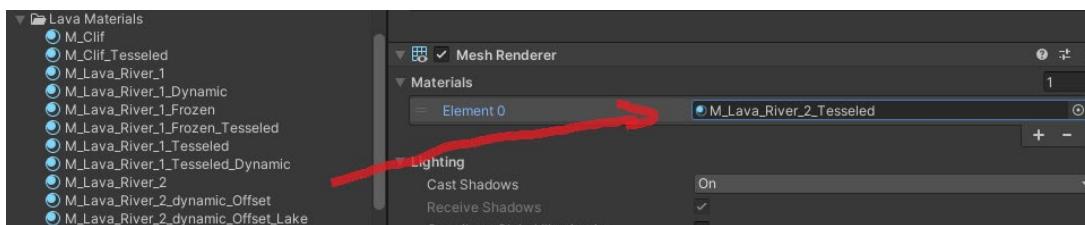
- You could drag and drop profiles that we prepared which contain info about:
 - material
 - mesh shape
 - UV directions and density
 - lake /mesh resolution
 - terrain carve
 - terrain painting
 - flow map
 - shape and flow map noises,
 - vegetation studio pro biomes
 - light setup

The whole lake setup is out of the box – drag and drop setup. It's very useful, you don't have to copy-paste any values anymore to create similar effects. Make note that we mark our profiles for R.A.M 2023 as R23_“Name” to avoid problems with older system versions.



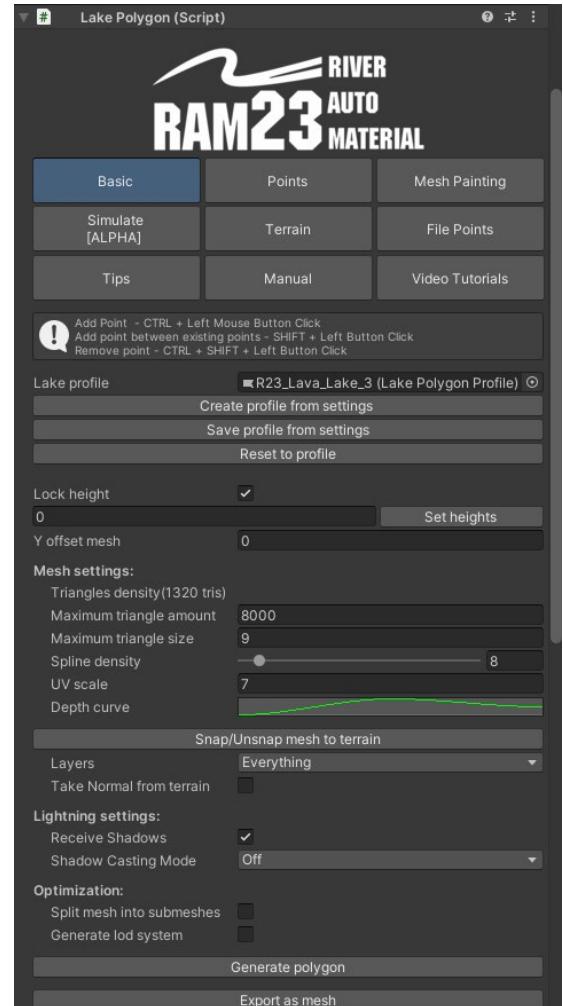
In our many assets like meadow environment where we use R.A.M lakes to lakes or other flat surfaces. In demo scenes, we always include profile files so you could simply drag and drop them and use them in your scenes without additional setup.

- You could drag and drop material from our library or create your lake setup from scratch and at the end save it as the profile. Just drag and drop material from the project into the mesh renderer component at the lake object

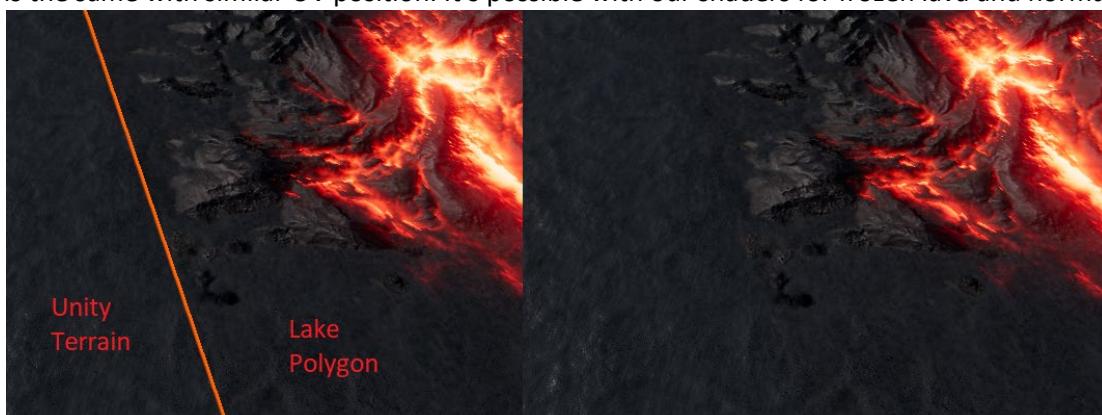


6. Basic Options

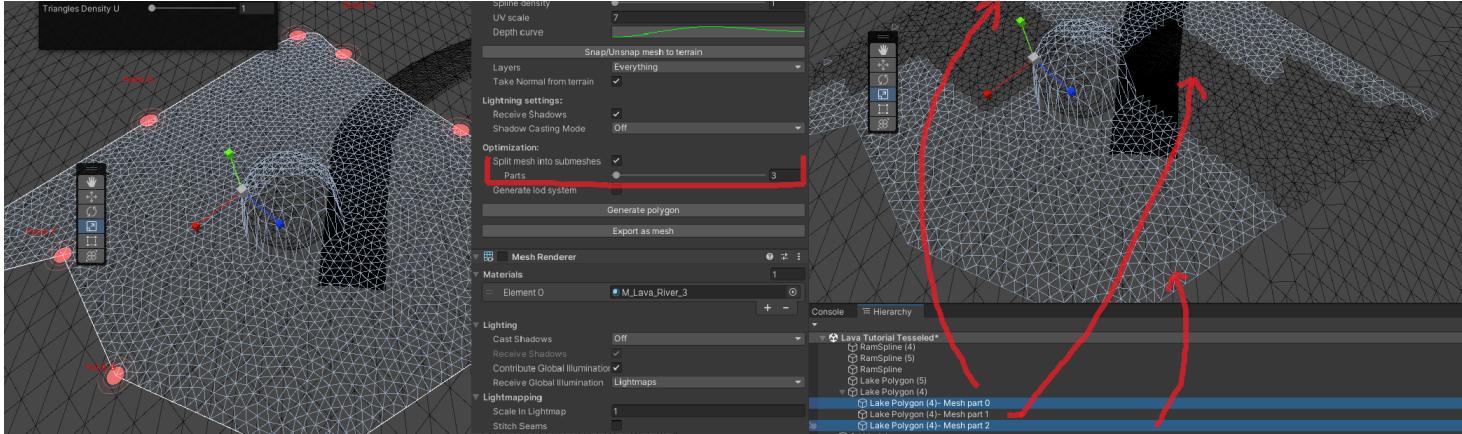
- **Lake profile:** You can drag and drop lake profiles to change the whole lake look/variant in 1 click.
- **Create, Save, Reset** to profile allows you to manage the lake, and save or revert changes made locally in the lake object.
- **Mesh settings:**
 - **Triangle density** – it shows the actual amount of triangles
 - **Maximum triangle amount** is the value that you don't want to cross with your lake, bigger shapes generate a bigger amount of triangles as the mesh is quite regular
 - **Maximum triangle size** is the value that set the maximum size of a single tringle.
 - **Spline density** is the quality of the lake border. If you want a straight orthographic lake border set it to 1. Higher values will make smoother connections between outside points.
 - **UV scale** setup tiling on the lake surface
 - **Depth curve** will be introduced in R.a.m 2023 water system. Its information for waves behaves on the big water surface.



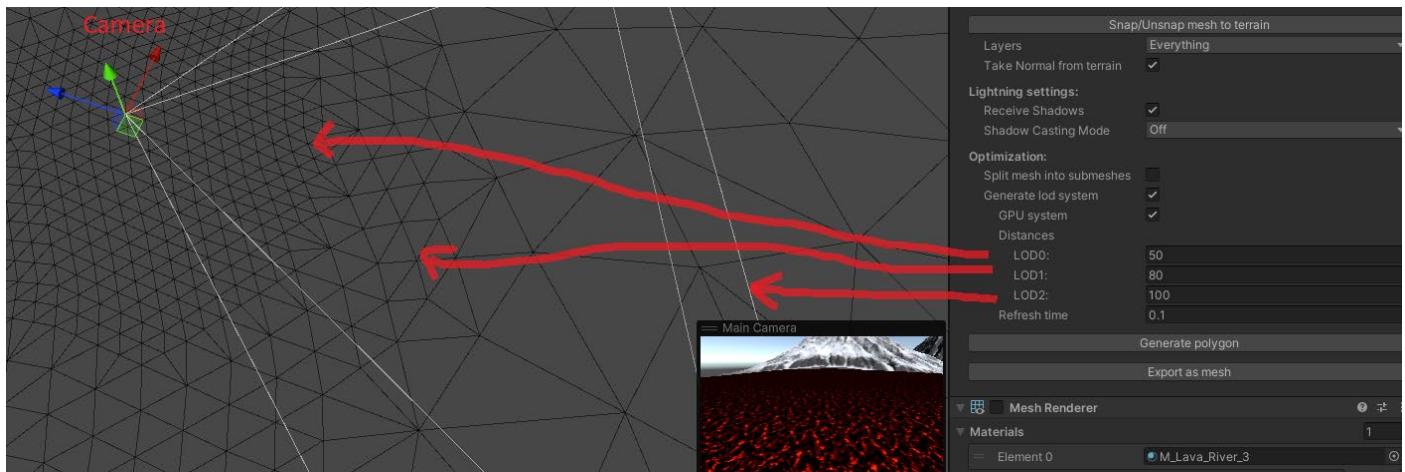
- **Layers** are used to set layers for collision detection under river lakes, for snapping, carving, and painting.
- **Snap/Unsnap** mesh to terrain allows to snap lake mesh to unity terrain, or any other colliders. For example, the sphere is like in this image. Just chose a layer with collider and spline will refresh the verts position and snap them to the surface.
- **Take normal from** that surface per vertex means the lake will take normal from the surface under the lake shape.
- **The slider** allows the management of the power of this normal, reduce, blend influence surface under the lake. This is a powerful option because it helps to blend spline 1:1 with unity terrain as long terrain and lake texture in that place is the same with similar UV position. It's possible with our shaders for frozen lava and normal 3d objects.



- **Optimization:**
 - **Split mesh into sub meshes** – it's helpful when you have huge mesh and you want to avoid rendering it as 1 object and mesh that cross 64k triangles which slowdown unity a lot.



- **Generate LOD** - works only in play mode with the camera. It tessellate lake triangles only close to the camera. Useful for huge lakes or sea which help to avoid holding big mesh with high resolution. Resolution is increased at runtime only close to the camera.
 - **GPU** – works on GPU and it's the fastest option
 - **CPU** – works on CPU it's much slower but it will work on devices that have problems with GPU.
 - **LOD0** – the distance where the mesh is most dense
 - **LOD1** – distance with /2 triangle density
 - **LOD3** – distance with regular triangle amount, non-tesselleed
 - **Refresh time** – how often the system will check the camera position and rebuild mesh close to the camera



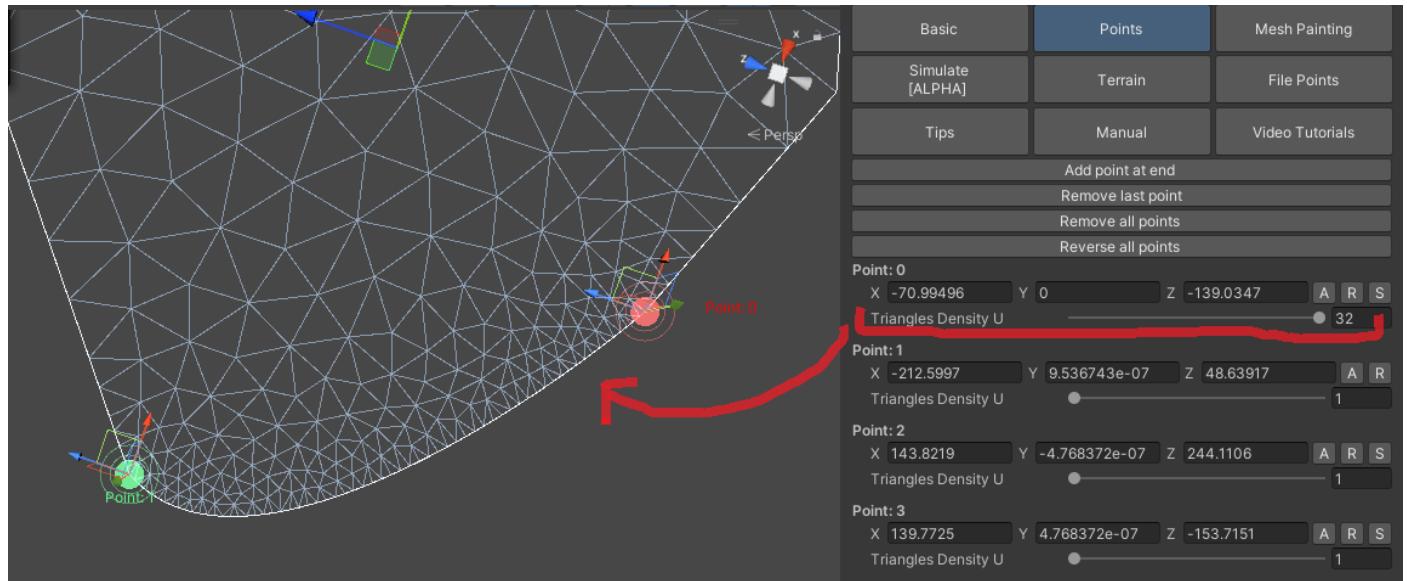
- **Lightning settings** manage basic options of the mesh like receive or cast shadows or not.



7. Points Options

In the points section you can manage the mesh shape at each point separately, add, remove points, and change.

- **Add point at the end** - it adds a point at the end of the lake spline but before 0
- **Remove the last point** – it removes the last point at the lake spline
- **Remove all points** – it removes all points from the lake spline
- **Reverse all points** – it changes points' order so the point will become at the actual end of the lake spline while the last point becomes the lake spline start.
- Each point has XYZ position
- **Triangle density U** allows increasing resolution on 1 border locally. It helps if we need to have good resolution only between a few points.



8. Mesh Painting

This part allows vertex paint spline mesh. You can vertex color triangles and paint values on UV (flow map)

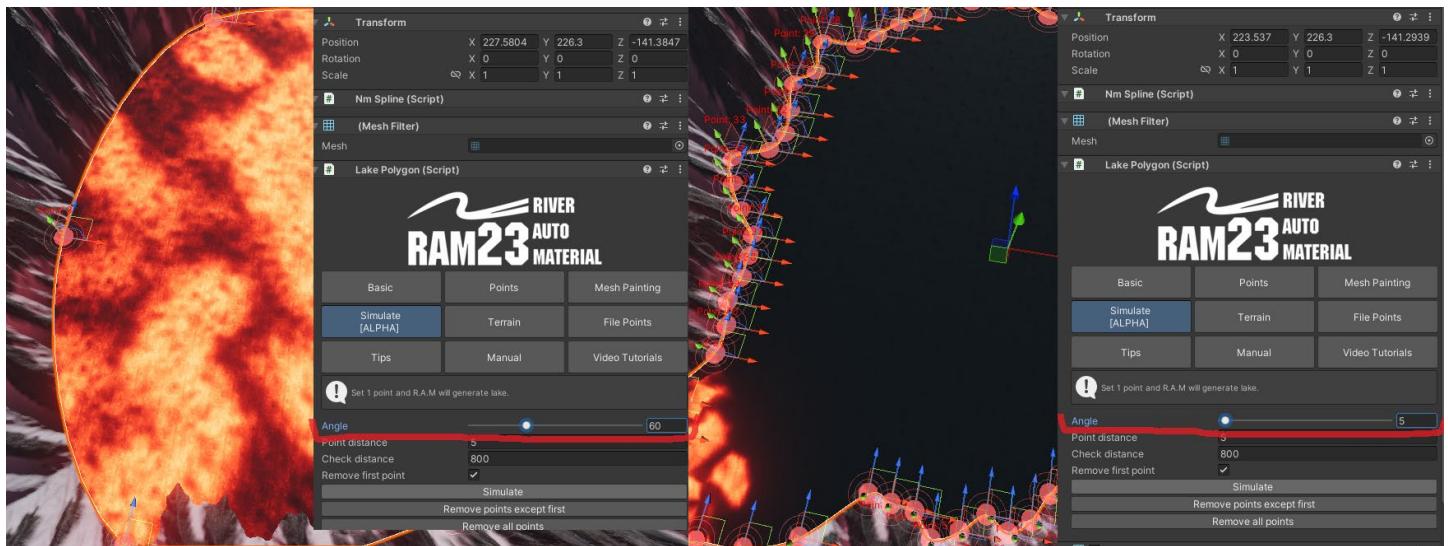
[It's an exactly 1:1 system like in spline mesh painting. Please check the section spline mesh painting for details.](#)



9. Simulate

This part is responsible for the simulation part. It means you place 1 point in the middle of the lake and click the simulation of the lake from that place. Our system will take slopes, distances, and point intervals into account and generate a lake. It's a very cool feature if you want to achieve a realistic lake on an existing surface to fill the hole with lake objects. In connection with API, you can generate rivers at runtime in your game.

- **Angle** – interval of the angle for ray cast from point to lake borders. Bigger intervals generate fewer points of the lake borders but it also means that the shape will be less accurate.



- **Point distance** – works the same as an angle but it counts the distance between points
- **Check distance** – maximum distance for ray cast from the initial point. If it will be too low it may not hit the whole border.
- **Remove first point** – it removes the point which was a source for simulation. Without that, the initial point will be part of the lake border.
- **Simulate** - it starts the simulation
- **Remove points except first** – it removes all points beside 1st so you can move it and start another iteration.
- **Remove all points** – it removes all points so you can place a new point for another iteration.



10. Terrain

This part of the lake setup is responsible for terrain carving and painting and the foliage removal process. It's based on profiles so if you set up carving or painting for specific terrain or lake type you can use it multiple times. We prepared example profiles to show possibilities and give you an easy start with the system.

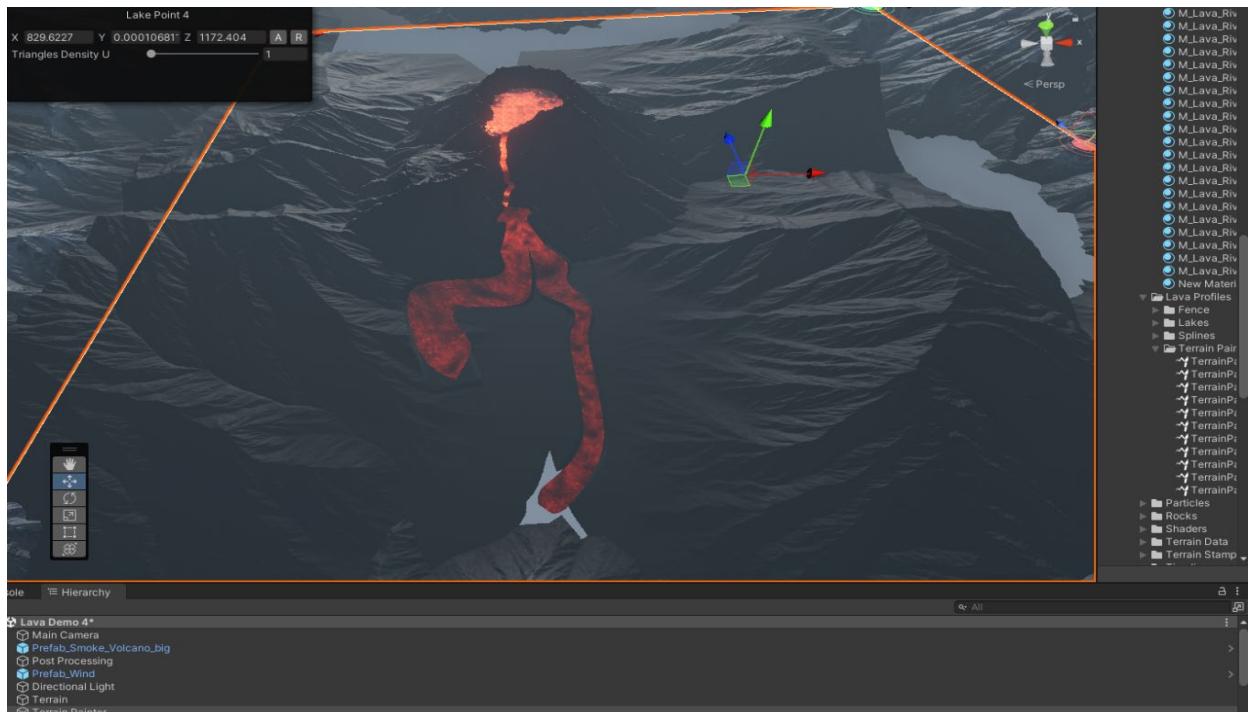
[It's 1:1 with river painting as it uses the same profiles. For setup please check the spline terrain part.](#)

We will show only interesting examples here.

If we create a lake that covers a big area of terrain it might be used to paint it automatically like we did at video tutorials. You simply create a huge lake object, apply a complex terrain painting profile and the whole terrain will be nicely painted.

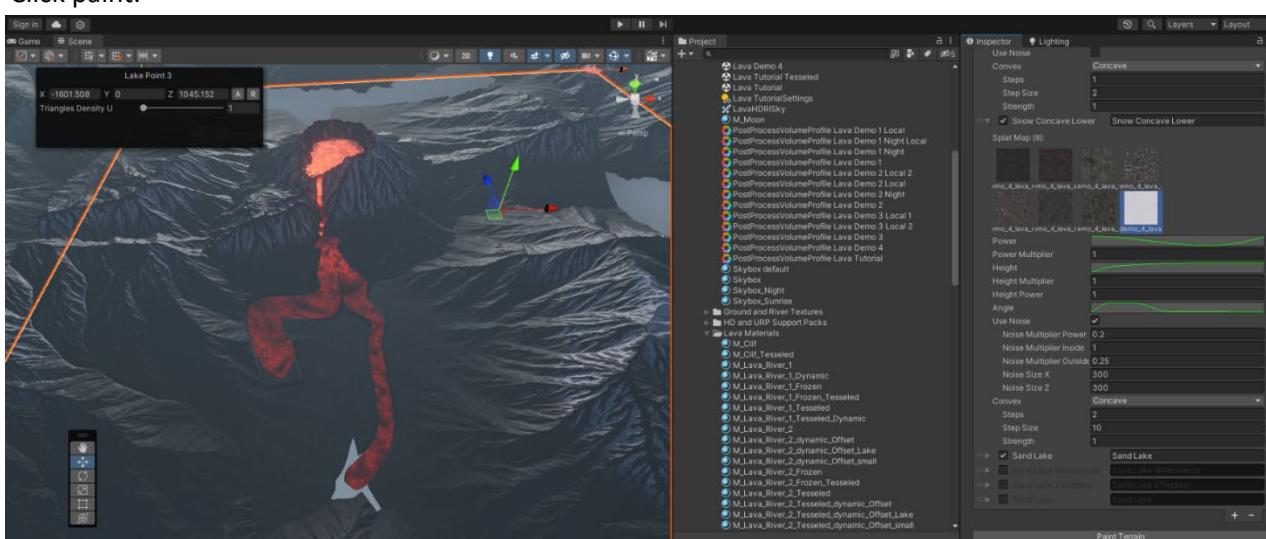
Look at the example:

1. Generate nice terrain using our terrain stamps.
2. Create a big lake polygon that covers the whole terrain



3. Drag and drop prepared painter profile

4. Click paint.



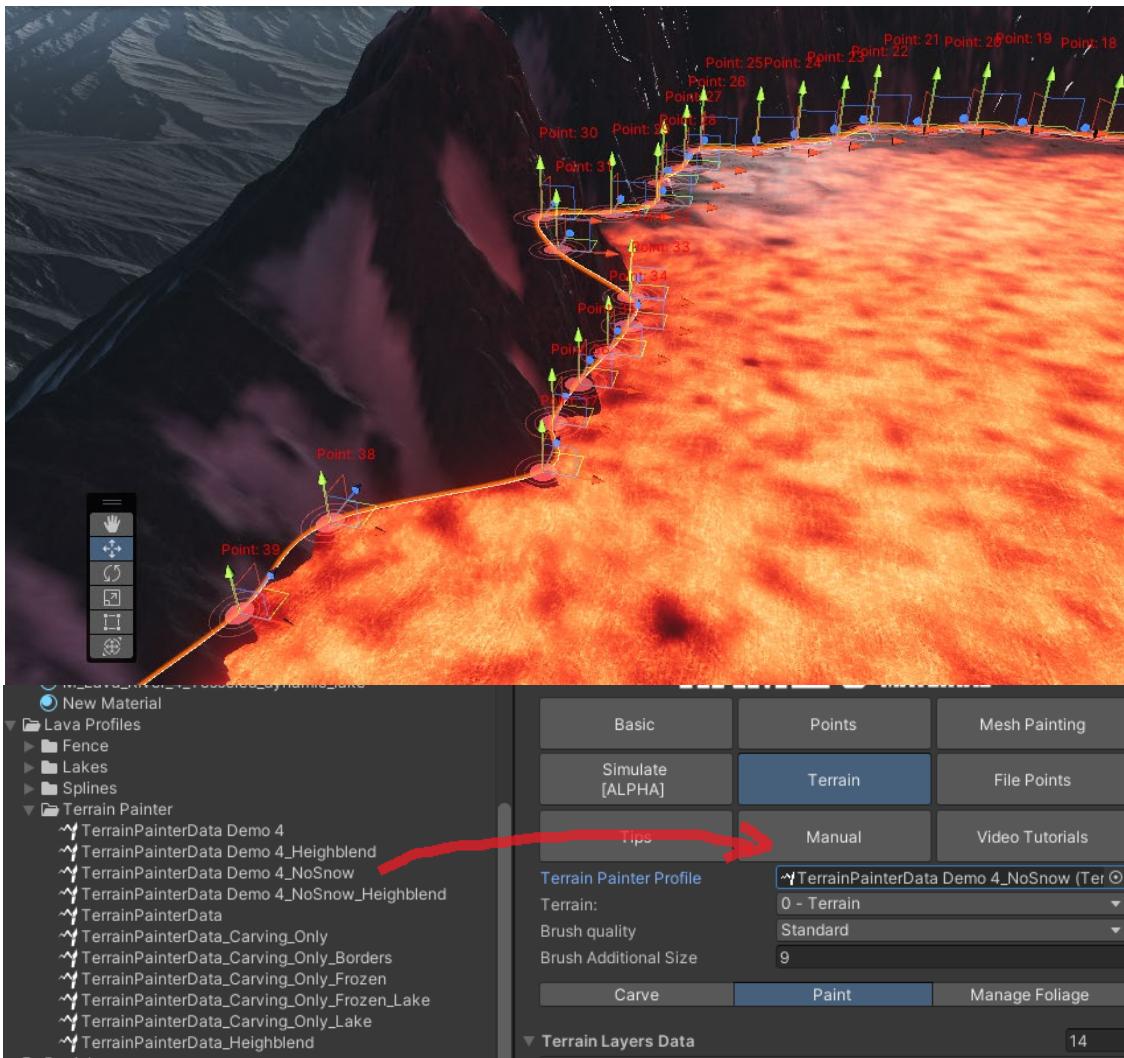
Support: Email contact: Naturemanufacture@gmail.com Web: naturemanufacture.com

Skype contact: dahrrrr Manual author: Bartłomiej Galas

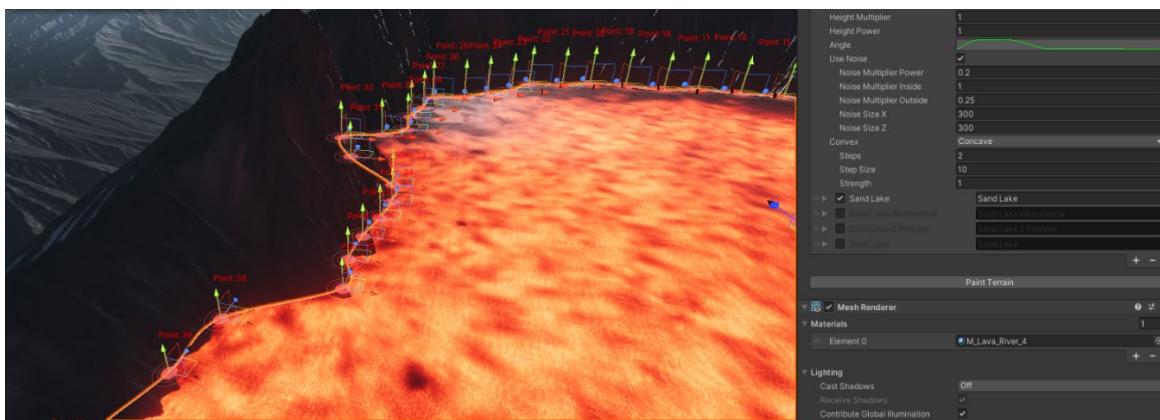
Facebook: <https://www.facebook.com/NatureManufacture-559454417506747/?fref=ts>



5. Now you can use same profile but without snow turned on to cull snow near lava surface. We go to the lava lake apply prepared “NoSnow” profile.



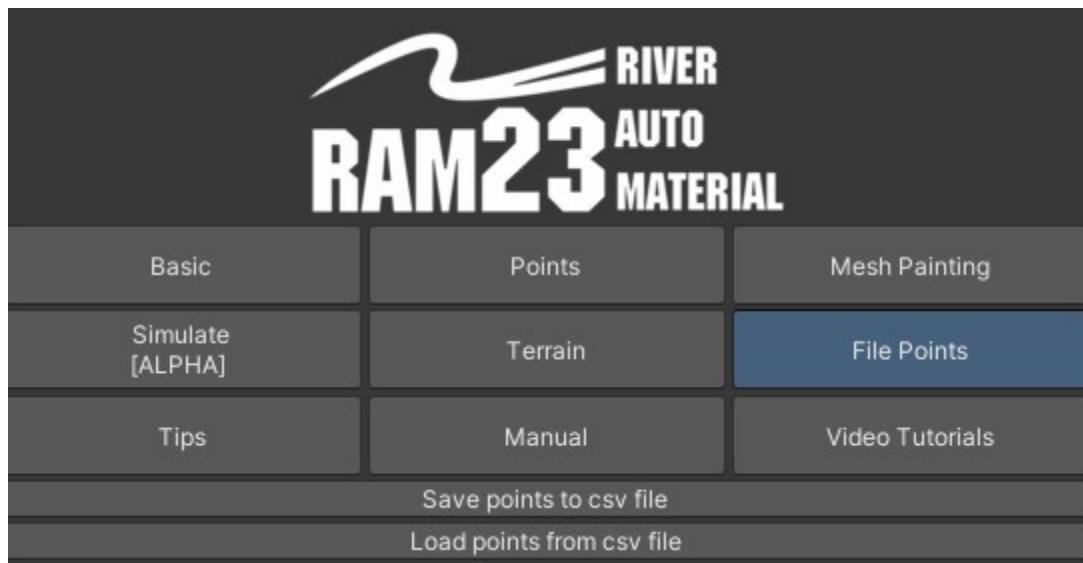
6. Click **paint** and the snow become removed.



The same process could be made for splines or you can create different biomes /profiles at your terrain and mix it via lakes/splines together.

11. File points.

You can import or export spline points into CSV files. It's helpful if you have a river defined from outside the unity or if you want to export a specific shape.



Water and transparent surfaces connections

Besides connections that are made in the spline interface, you can connect different surfaces via vertex alpha.

Alpha connections – works with any water and transparent surface, you can even connect lava with water, a swamp with sea, etc. This allows you to connect our system with any other water system from the store.

- River mesh must be above the second river mesh, not much just a bit
- 1st river mesh must have a higher render queue in the material than 2nd.

For example 1st river = 2999, 2nd river = 2998. This will avoid “Z-fighting” between transparent surfaces at low angles or far distances.



- 1st river must be blended with 2nd river via vertex alpha in spline vertex painter. This will generate a smooth transition.

Here we connect swamp water with mountain rivers. Without vertex alpha color connection there would be hard separate lines between these 2 surfaces.



- In such a way you could connect the waterfall which drop water into a lake or river even if these 2 surfaces have different direction that cannot be handled by splines.

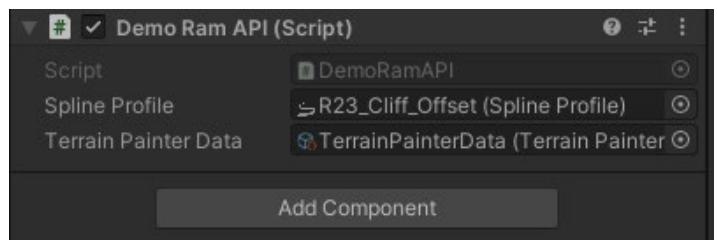


API

These functions will help you to build splines, lakes, and fences in play mode in your games and apps.

We have an example script called: “**DemoRamAPI**”.

Place it on an empty game object at the scene and in play mode you can build splines by clicking points on the screen. You do it via your chosen profile for terrain and spline.



NmSpline

- **Adds point at end of spline** - AddPoint(Vector4 position)
- **Adds point in the middle of the spline** - AddPointAfter(int i)
- **Changes point position**, if the new position doesn't have width old width will be taken - ChangePointPosition(int i, Vector4 position)
- **Removes point in spline** - RemovePoint(int i)
- **Removes points from point id forward** - RemovePoints(int fromID = -1)

TerrainManager

- **Carves terrain around spline** - CarveTerrain()
- **Paint terrain around spline** - PaintTerrain
- **Clear foliage around spline** - TerrainClearTrees(bool details = true)

River

- **Creates spline with points** - CreateSpline(Material splineMaterial = null, List<Vector4> positions = null, string name = "RamSpline", bool snapToTerrain = false)
- **Generates river spline** - GenerateSpline(List<RamSpline> generatedSplines = null)
- **Adds noise to river widths** - AddNoiseToWidths()
- **Simulates and generates river** - _ramSimulationGenerator.SimulateRiver(bool generate = true)

Lake

- **Create lake polygon** - CreatePolygon(Material material, List<Vector3> positions = null)
- **Generate lake polygon** - GeneratePolygon(bool quick = false)
- **Simulate lake** - _lakePolygonSimulationGenerator.Simulation()

Fence

- **Creates fence generator** - CreateFenceGenerator(List<Vector3> positions = null)
- **Generates fence** - GenerateSplineObjects(bool quick = false)



Lava Materials

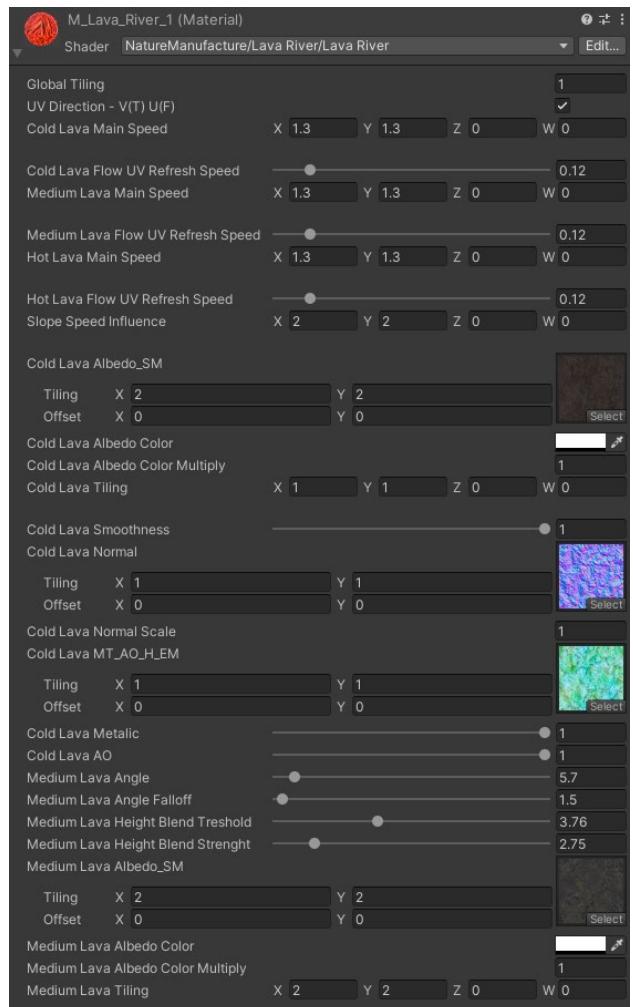
In Lava shading be sure that you have bloom turned on, it's impossible to adjust emission without bloom on screen. Emission only shows up when the bloom effect is turned on at the engine post-processing stack or other post-process that you use.

This pack contains a few shaders which have a different amount of features. We will show here the most advanced as the rest simply have just a lower amount of options but they work the same.

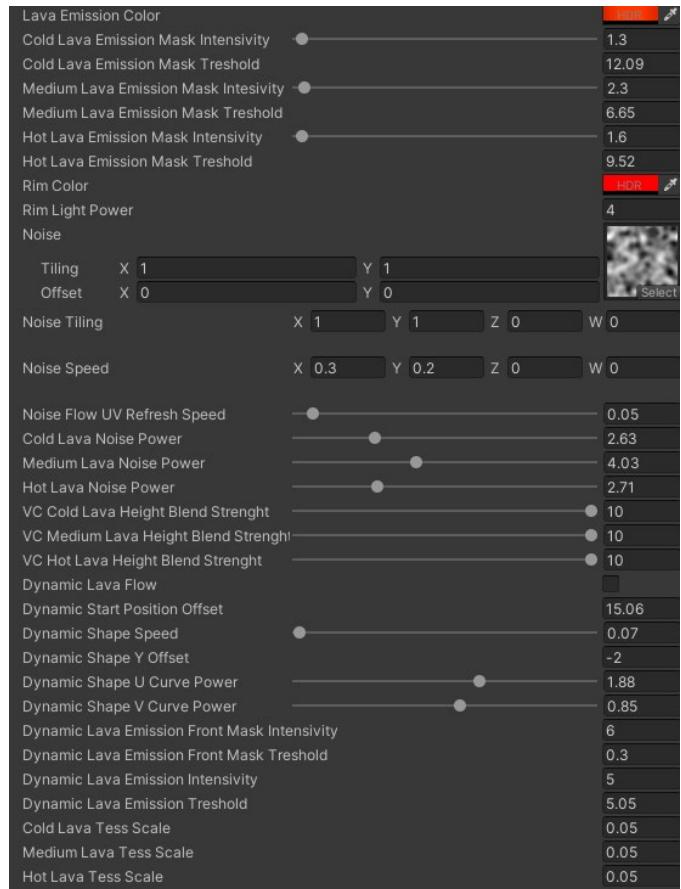
Lava contains 2 kinds of materials hot and frozen.

Hot lava shading

- **Global tiling** – it changes the tiling of the material without changing every layer and texture tiling separately.
- **“UV- V U directions”** – it manages lava moving direction. By changing it you could rotate movement by 90 degrees.
- **Cold Lava** – this sentence means behave on the flat area
- **Medium Lava** – this sentence means behave on a medium slope direction
- **Hot Lava** – this sentence means behave on a big slope direction
- **Main Speed** – it changes texture flow speed. Make note that too big speed break flow map move
- **UV Refresh speed** – you can manage the speed of flow map refreshing, it removes UV problems that appear when the texture speed is too big and also speed up texture move. Fast refreshing generate the odd effect of replacing textures. It must be used softly.
- **Slope Speed Influence** – besides the option that hot or medium lava may be set faster than cold you can set every speed to the same values and multiply texture speed via slope by this value. Its best effect is to speed up the surface when it starts to move in a more vertical direction.
- **“Cold Lava color and its multiply”** – will manage albedo color.
- **“Cold Lava Main Speed”** – is used to control lava speed also on the flow map.
- **Cold Lava Metallic, AO, Smoothness** – These values manage the PBR character of the cold lava surface.
- Notice that at alpha channel lava MT_AO_H_EM texture contain an emissive mask. B channel is used for height-blend and heightmap for tessellation



- **Medium/Hot Lava Angle and Falloff** – these values manage angle value and blending where lava starts to use second layer textures and setup
- **Medium/Hot Lava Heightblend Threshold** – you could adjust heightmap using height-blending at a mix between cold and medium lava. The threshold value will make this blend harder, and sharper.
- “**Lava Emission color**” is the color that lava will use in emission.
- “**Cold/Medium/Hot Lava Emission Mask Threshold**” – it adjusts the threshold of the emission mask, you could make it more or less sharp (not the same as power)
- “**Cold/Medium/Hot Lava Emission Mask Intensity**” – it manages the power of emission from the mask which is left from the threshold adjustment above. This is the main value to manage emission power for each lava layer.
- **Rim Color and Power**– it’s the effect that appears only in a specific view direction. It shows up when the angle between the camera and the lava surface is low. It’s just an additional nice emission effect. You can manage its color and strength.
- **Hot and medium lava noise power** – Lava use noise on emission to simulate additional physical heat movement inside the lava surface, these values are used to control its sharpness. Too sharp noise could generate strange results. It also uses a flow map for additional mixing effects so you can manage its speed and UV refreshing density.
- **VC Cold, Medium, Hot Height Blend Strengths** – as you can paint on lava via vertex paint, these values help you to manage height blending sharpness between layers when you mix them via vertex colors.
- **Dynamic Lava Flow** – a cherry on the cake. It active “dynamic” values below which are responsible for dynamic lava movement.
- **Dynamic Start Position Offset** – value that set the position of lava on the spline when you hit play.
- **Dynamic Shape Position Speed** – value which set how fast lava will move, it must be correlated, and adjusted with lava speed and flow map to avoid the strange effect that texture on lava surface moves faster or slower than mesh
- **Dynamic Shape Y offset** – lava movement is predefined we simply move/hide our spline under the ground and objects until the lava front will be near enough. You set up how deep you want to hide lava in that place.
- **Dynamic Shape U and V Curve** – you can set up the shape of the front lava surface during the flow process. With these 2 sliders, you can easily make shapes that fit your goal
- **Dynamic Lava Emission Front mask, threshold** – this value helps you to mask/heat the lava front so the effect will become more natural.
- “**Cold Lava Tess Scale**” – if you use a tessellated or offset shader it will pop up verts using heightmap texture.

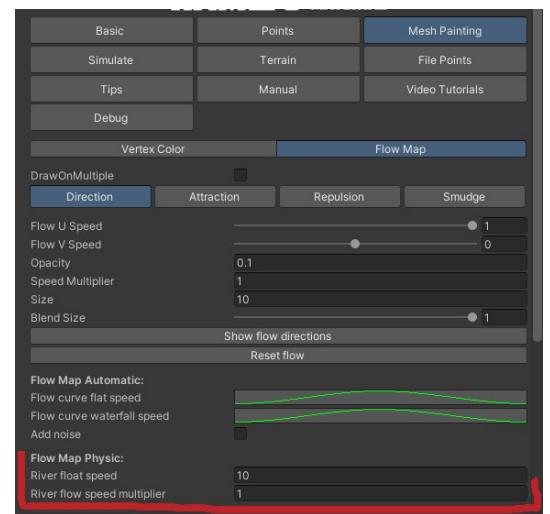


Frozen Lava Shading

This shader is used to simulate eroded old lava rivers which could be blended via vertex colors with background textures. It blends 2 layers, lava and cover. The tessellated shader is designed to fill gaps in the main texture by covering slowly while the amount of cover is rising. Ash or background starts to fill holes and move verts up and at the end it starts to cover the top verts. It's a very realistic construction which gives a lot of fun. Shader is very sensitive but you also could use it on rocky roads a forest or any other case. Anyway, the shader works the same as this above but it's focused on different blending types between surfaces. You have 2 base layers with heightmap that you can mix. It works the same as the unity layered HD RP shader but we added an emission effect.

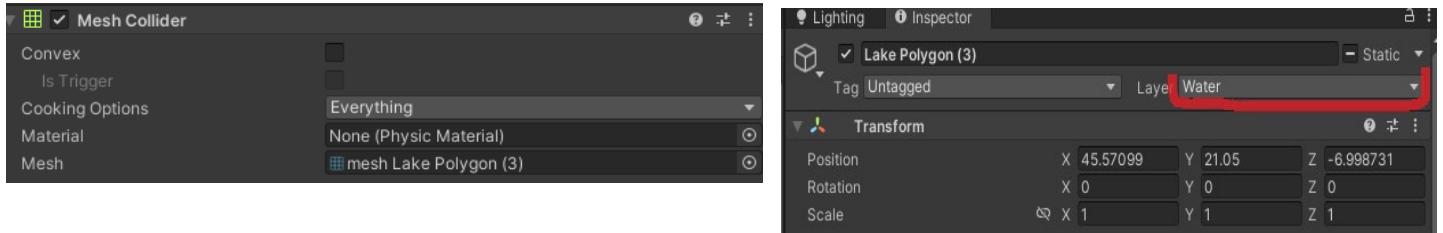
Physics

Physics move is based on information from our river and lake flow maps. The object will speed up in places where the flow speed is high etc. You probably notice that Lake and Rives have “**River float speed**” and it’s multiply in “**Flow Map**” panels. This value can multiply the relation between the flow map and physics speed at the water surface

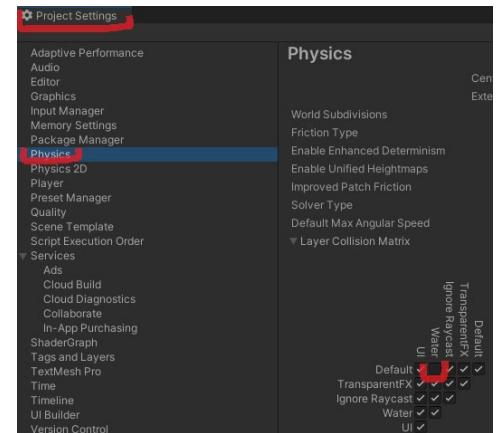


To move objects dynamically on river and lake surfaces you have to do only a few things:

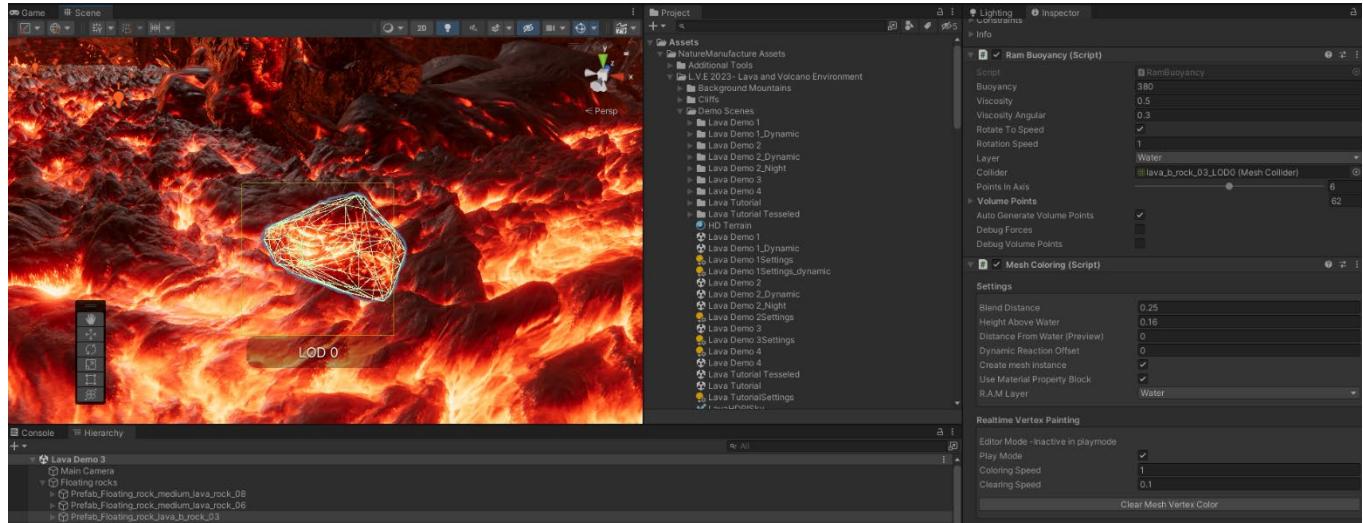
- All surfaces must have a water layer and mesh collider



- In physics options at project settings, the interaction between default and water must be turned off



- You have to add RAM buoyancy script to your object. If it has LOD's it must be at the top of LOD's object. It will automatically add a rigidbody to your object. Set the **Water layer** as a layer for collision detection inside the script.



- Add a collider to your object. It could be a box, capsule, or mesh with checked "convex". Remember that collider type will have a big influence on object behavior. Do not add a box collider on the rounded object, use rather a capsule, etc.
- Adjust mass in Rigidbody and buoyancy script. We type pretty nice values on the screen above, I hope they will fit your goal. Values are estimated and for different objects must be different. Too high mass or too low buoyancy will force an object to go into the river bed instead of flow on its surface
- You could also play with Collision detection in Rigidbody. Continuous Dynamic will give the best result but it's most expensive.
- Points in axis** – Amount of points in each axis taken into physics calculation. Keep it pretty small to reduce CPU overhead. 3 is enough
- If you add mesh coloring script as well with play mode checked on rock will become heated at runtime and the system will take into account which part of the rock is above the surface and how far.

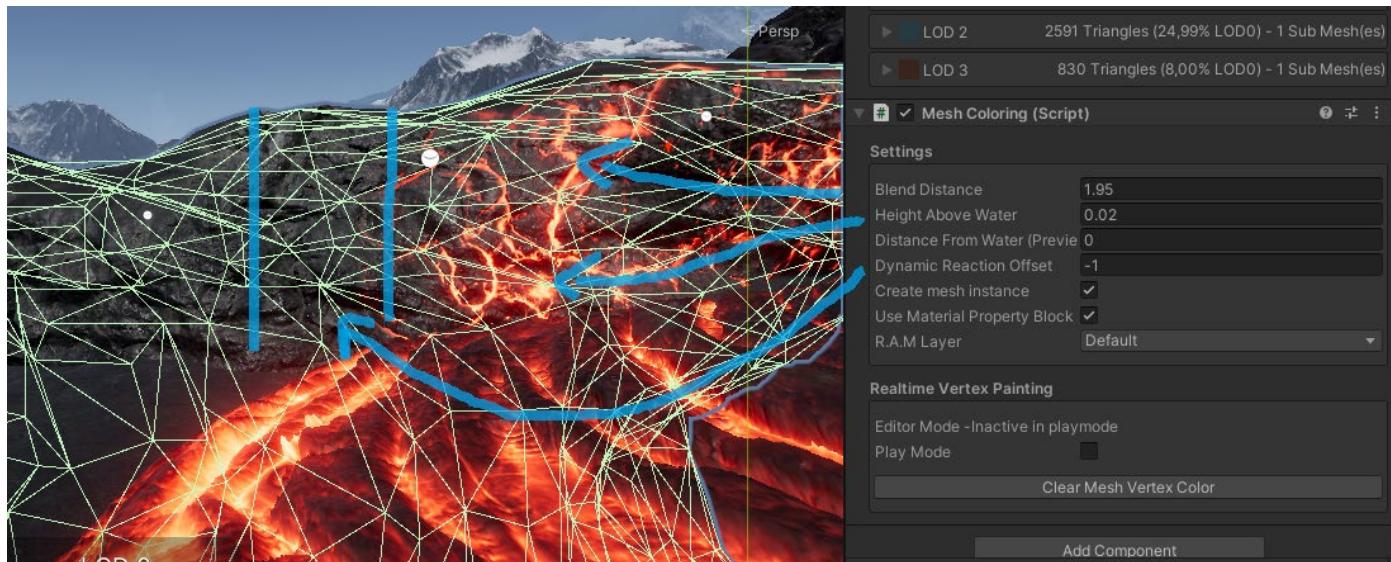
When you hit play physics will start working and objects will start to move over the lava surface.



Automatic rocks heating and wetness.

Simply drag and drop our Mesh Coloring script into the object, LOD parent. It will detect R.A.M and make stones hot/wet by our spline surface. You also could make an object dirty if it hit a spline or lake if your shading at material supports it. We paint the vertex color R to heat or make objects wet.

- **Height above water** – Vertical triangle distance from spline that is affected heat/wet or any other effect.
- **Blend distance** – Vertical blend distance to make a hard or soft blend between affected and unaffected areas.
- **Distance from water** – Horizontal triangle distance from spline that is affected heat/wet or any other effect.
- **Dynamic Reaction Offset** - Each affected object by spline/lake read its information about at which stage lava/water is. So for example if lava flow dynamically material reads lava offset values. This means that rock will become affected in proper time. You can offset that time to get a nice effect, for example, the rock will become heated after 5 seconds when lava moved through it.

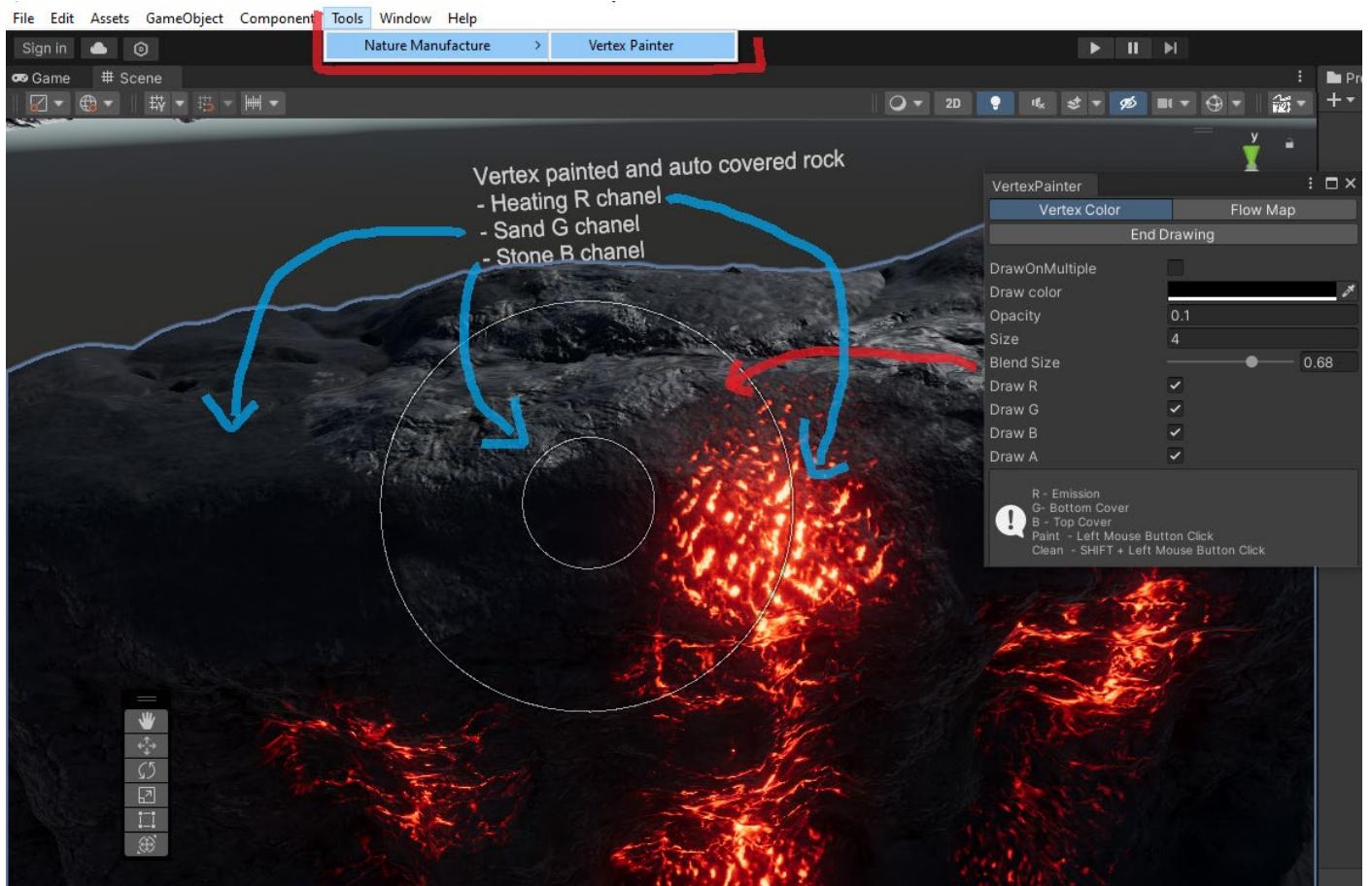


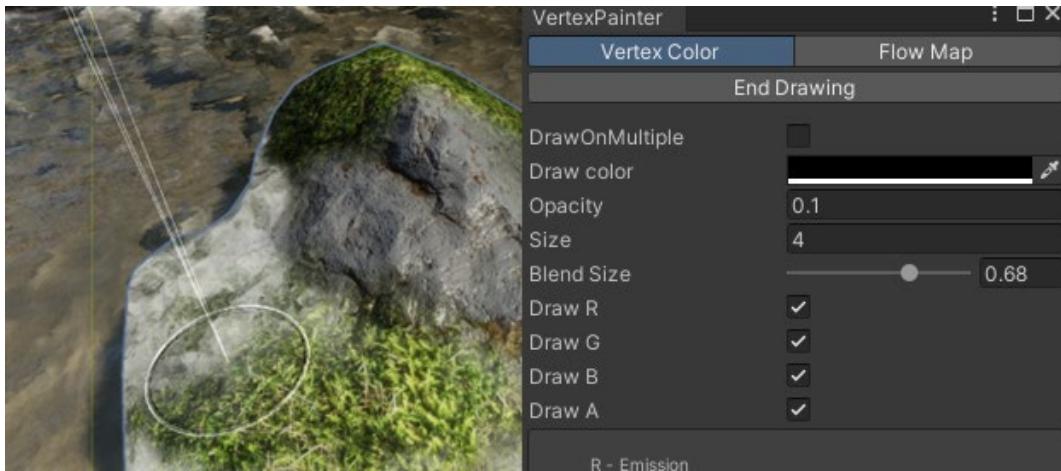
- **Create mesh instance** – We often copy objects in the editor to avoid creating a setup again we prevent sharing the same mesh across many meshes when you copy an object. Without it, this would generate problems like when you color 1 object it will change all of them.
- **Use Material Property Block** – each object with the material might be in a different place on the lava spline so it needs different offset values as they become affected at different times. This creates a material property block and allows for instance different offset values at the same material.
- **R.A.M layer** – it allows us to choose which layer should affect our meshes. You may have a few splines one over another and only one of them should heat or make our objects wet.
- **Editor mode** – the object will be colored when you move it and touch the spline surface
- **Play mode** – coloring will be refreshed at play mode. Useful for objects that touch or flow on spline/lake surface.
- **Coloring and Cleaning Speed** – Available only in Playmode mode. This avoids the situation the object lost relation with the spline or lake and automatically back to normal. It also means that when the rock hit the lava/water you can set up a time for how long it must touch its surface to become hot/wet and how long time it needs to become cold or dry again.

Vertex / Flow map Painter (all other meshes then spline)

This tool gives the ability to paint on vertex and UV to get additional effects that depend on the shader that object has. In the river, it will make rocks wet, but in lava, it will heat stone or even overlay it with chosen textures like rocks or sand. By UV painting you could paint flow maps on models – this means that you could put our water or lava on any object and paint flow maps etc on it as we did in floating island objects. **R.A.M spline and lakes mesh should be painted via spline tools and lakes tools**, otherwise, systems will restart your data, for all other meshes, this tool will be best.

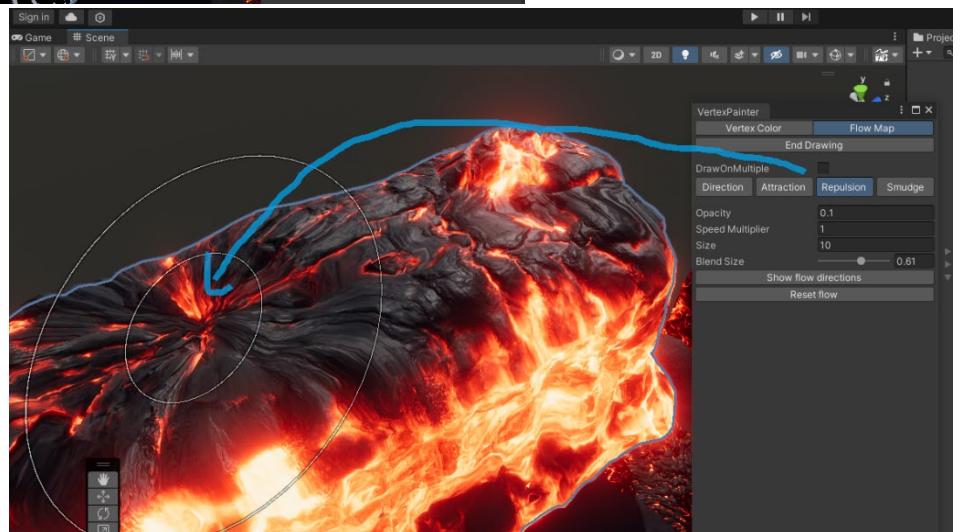
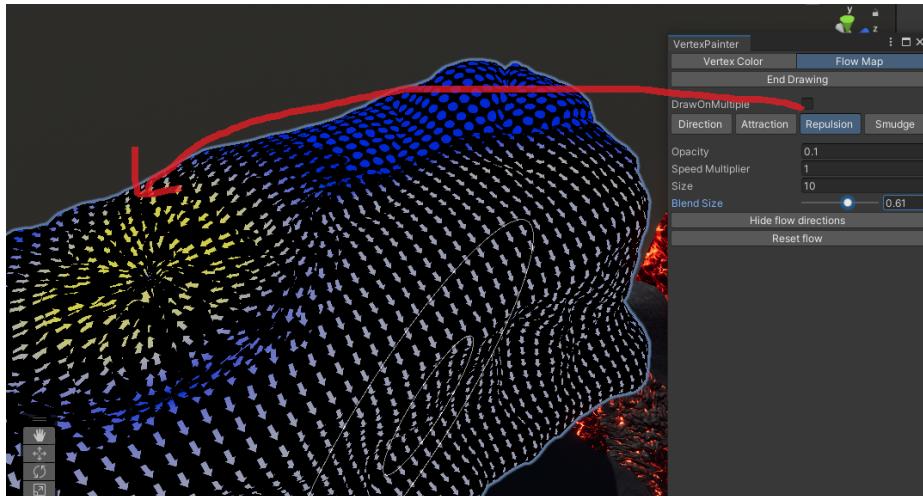
- The default color is white – no actions. By decreasing power or turning off colors R, G, or B it starts to show effects in our shaders.
- We choose white because the shader must work without any effects on default white meshes too.
- **Always check the mother** (object with LOD group) to paint on every LOD at the same time. If you will check only LOD_0 etc only this lod will be modified. Rest will be untouched. For small changes, it's pretty cool to leave the last LOD untouched to save GPU and memory. You always could paint on all LODs and at the end change/reset the last LOD mesh to default.
- We added a flow map painter which works the same as at spline river. Flow map painter on meshes was used in our floating island demo.





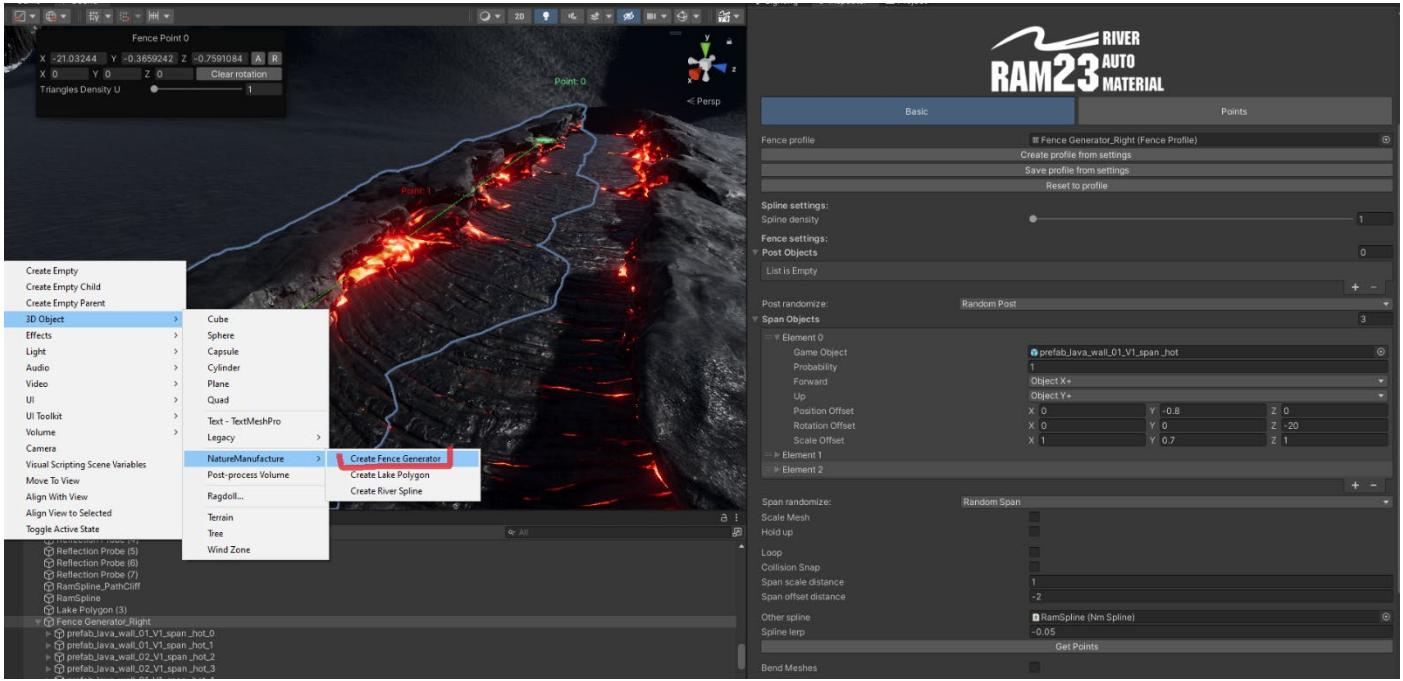
Flow-mapped shaders are very sensitive. The gradient between directions must be smooth, mostly in tessellation shaders where verts must smoothly change UV and direction. We give to debugs.

- **“Show/Hide flow directions”** – It will show/hide arrows with colors that show the direction and speed of the water. Red is big speed while blue is slow, dots means stop. Be careful and blend speed, don't create a hard gradient.



- **Direction, attraction, repulsion, and smudge work 1:1 like in our spline and lakes. Check the flow map section**

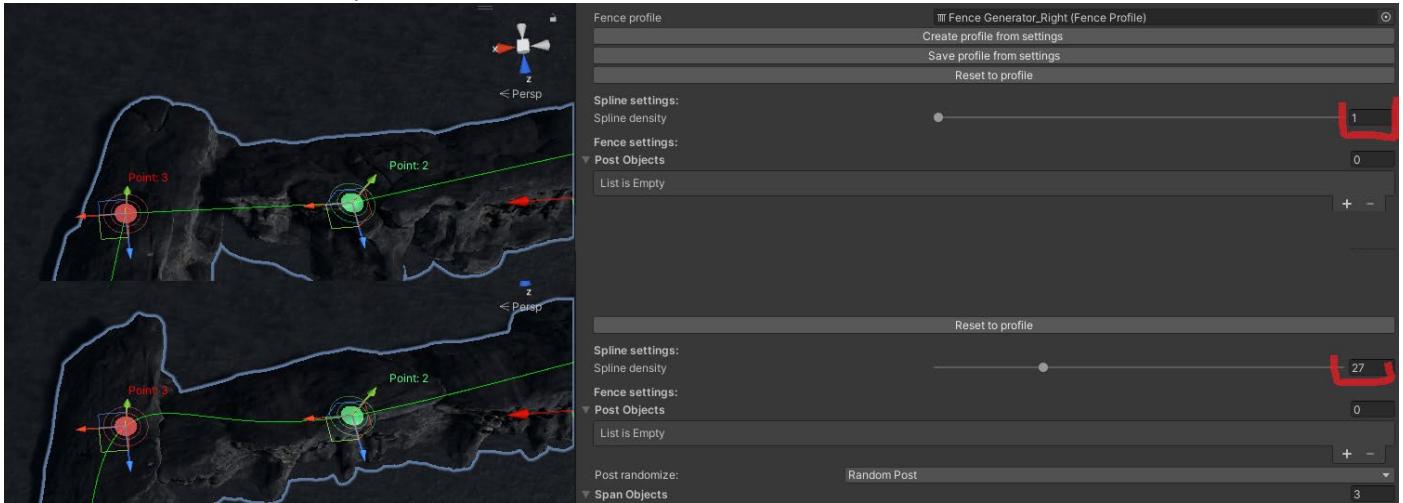
Fence Tool



You can create our fence object in by: Hierarchy window “+” panel by choosing **3d Object -> NatureManufacture -> Create Fence Generator**.

With our fence tool, you could create a very advanced mesh that will follow your spline or river/lake. It also works with profiles so you have an easy drag-and-drop process to get specific fences out of the box.

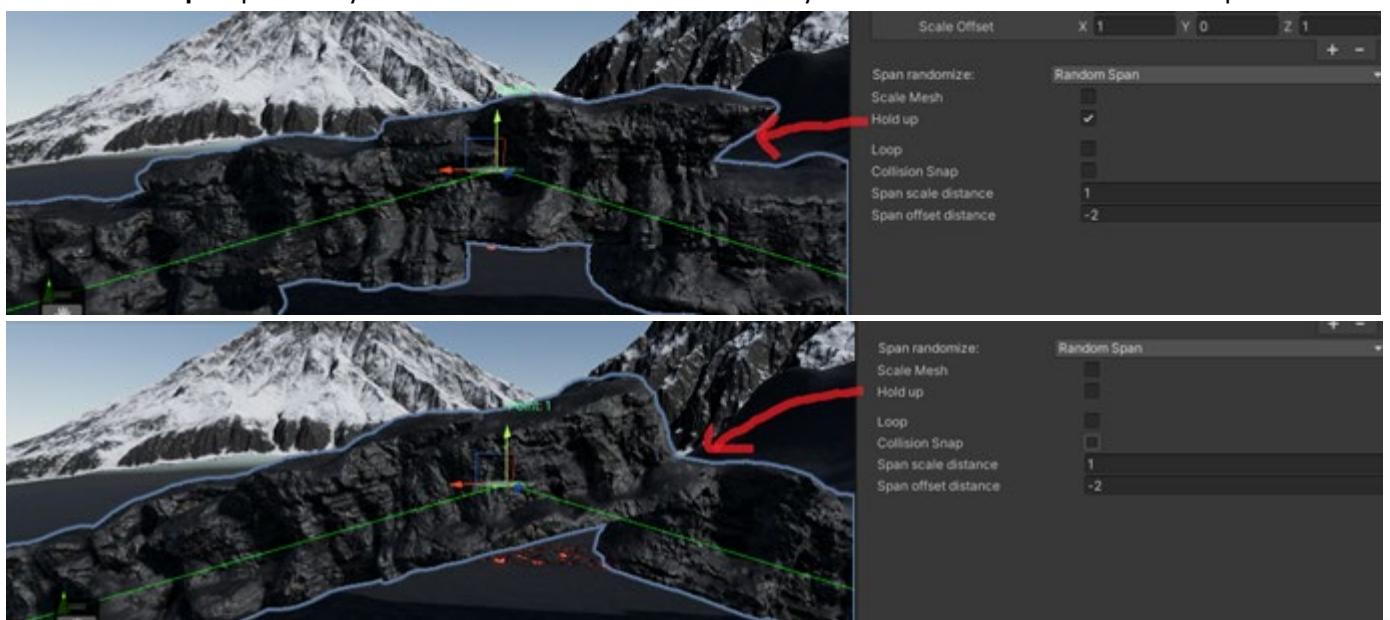
- **Create, Save** – you can create a profile or save changes made in the already chosen one.
- **Reset to profile** – will reset all changes made locally in your profile
- **Spline density** – resolution, the curvature of the spline that the fence will follow. For orthographic construction please use value 1.



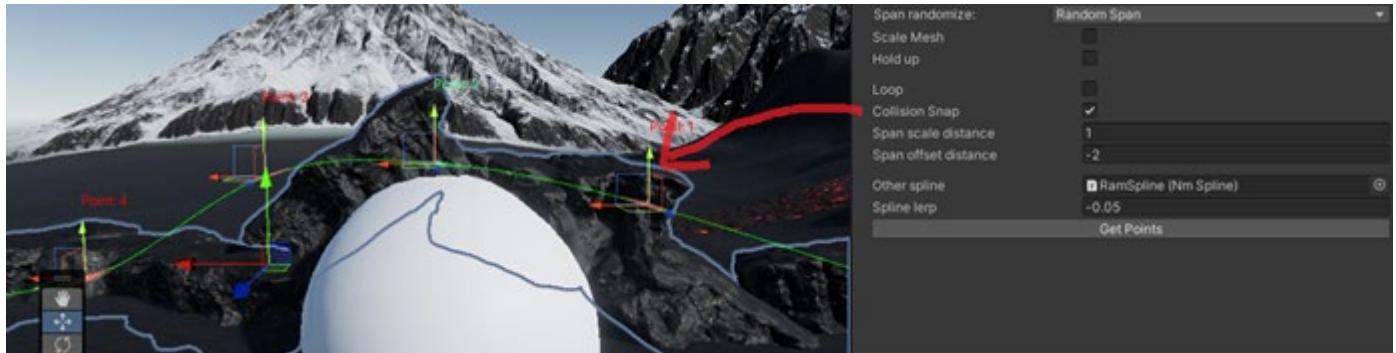
- **Span and Post object** – you add objects which will become spans or posts in the fence. Post is object between each span.



- **Probability** – the chance to spawn this specific object. It works only if you have multiple spans or posts in the list. Objects with a bigger probability will spawn more often.
- **Forward and UP** – direction of the model in the fence. Some objects have different model axis directions so this option may fix that or you can use it to create one side fence. For example, the left road border will have -X while the right X+ on their forward setting. Same thing you can achieve by rotation of the span object by 180.
- **Position offset** – it offset position.
- **Rotation offset** – it offset rotation. It might be used to create a left or right-side fence.
- **Scale Offset** – you can multiply the scale of the object.
- **Span randomize** – it may spawn objects in sequence so elements 1,2,3 or random.
- **Hold Up** – span always will be in the horizontal direction if you uncheck that it will follow the spline



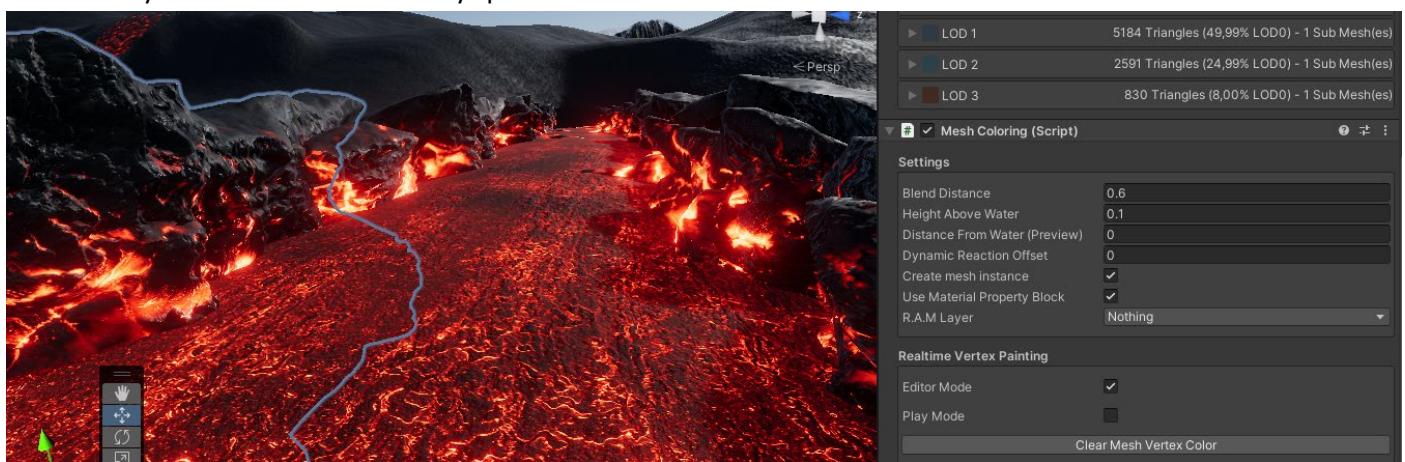
- **Loop** - it will connect the end and beginning points so the spline and fence will be closed structure.
- **Collision Snap** – it will snap fence objects to ray-casted collisions.



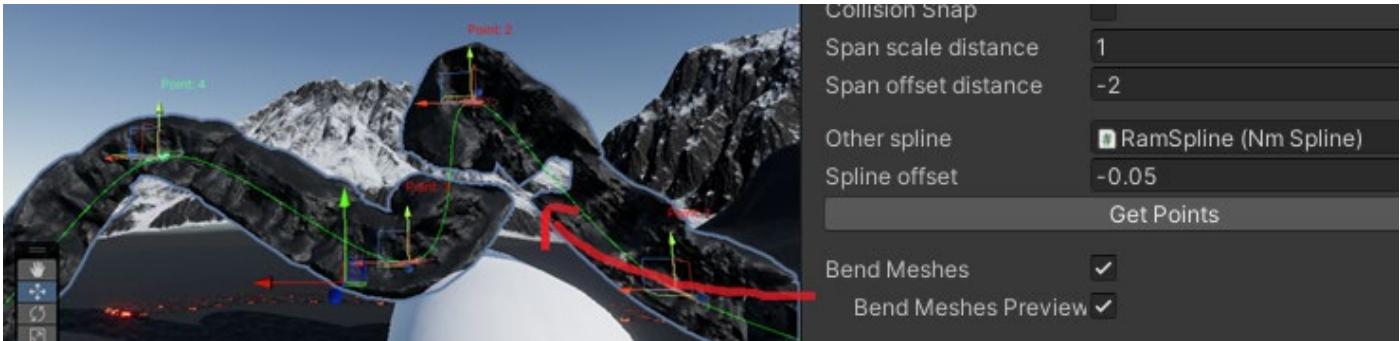
- **Span Scale distance and Offset** – it regulates distance and offset between span objects. Low values can generate a mess and a big amount of objects.



- **Other spline** – if you drag and drop our river or lake here it will take their points as your own. This synchronizes our fence with splines and lakes. You can create a lake border or a road border. The cool option is that if you use prefabs with our mesh coloring script it may paint span objects out of the box so they become wet or heated by splines out of the box



- **Spline offset** – you set up offset value here in relation to lake or river spline.
- **Get points** – useful if you connect the fence with our spline or lake, the system will take their points and use them as your own. It refreshes the position of the point.
- **Bend** – this is a cool option, it will bend your objects so they will follow the shape of the spline. This option modifies meshes and their normal.



- **Bend meshes preview** – it will real-time rebuild bent meshes when you move spline points. It might be heavy for your pc with long splines and a big amount of objects.
- **Generate fence** – it rebuilds refreshed fence.
- **Auto-generate objects** – it spawns objects in real-time when you move spline points.
- **Clear fence** – it clears 3d meshes in the hierarchy fence object.
- **Clear All objects children** – it's hard to reset if there left any objects under the fence spline parent even if you clean it.
- **Debug** – it shows normal, tangents of the spline.

Particles

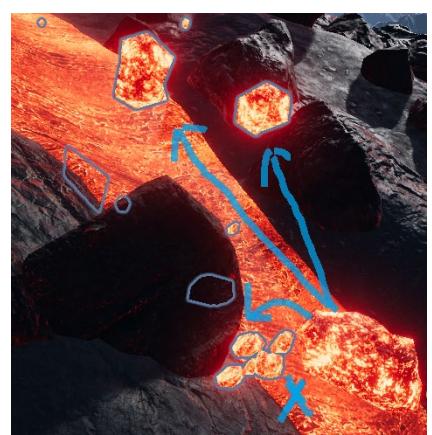
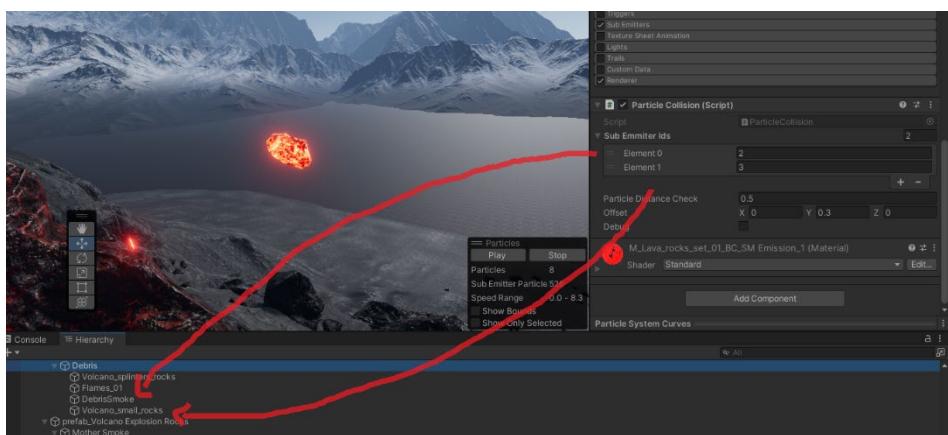
1. Shaders

Our particle shaders have separate PDF manuals as they are really complex. Please search for it inside the project:

- Fire Shader Manual
- Smoke Shaders Manual

2. Scripts

In our volcano, we used a specific script that works only in play mode. It's used to make workarounds over the engine particles bug. We spawn or block spawning sub-particles by it.



It allows spawning sub-particles only after the first collision. It means when the rock hit the ground or other collider it will spawn smoke/explosion and small rocks only once, during first collision. You setup elements which should be

Support: Email contact: Naturemanufacture@gmail.com Web: naturemanufacture.com

Skype contact: dahrrrr Manual author: Bartłomiej Galas

Facebook: <https://www.facebook.com/NatureManufacture-559454417506747/?fref=ts>



affected by this script and these particles will be spawned only once. This avoids situation when the rock still rolling on the ground and spawn small rock parts like from bigger collision hit.

3. Distortion VFX vs Unity Particles

For the distortion effect, we used VFX graphs at URP and HDRP as they are super fast while in build in we used a unity normal particle system as VFX doesn't work on built-in. That may generate a small mess in files.

