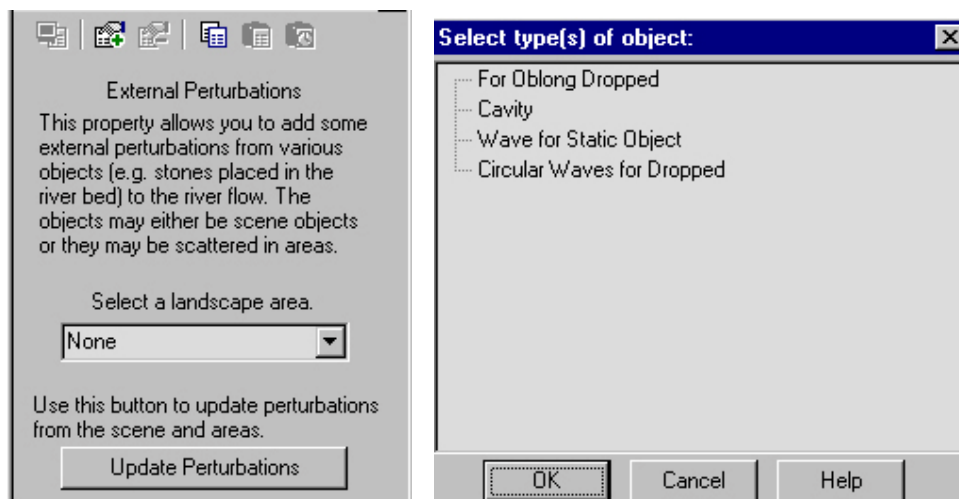


River tutorial: Part 2. External Perturbations.

Start World Builder and load Projects/RiverPart1_04.awb.

Up to now the only animation of our river was the procedural flow. WB allows also to add some extra animation to the water surface by means of the so-called External Perturbations. The main idea of this kind of animation is that we place an external object to the river channel and tell the river to create some kind of surface perturbations from the object. All the External Perturbations are subdivided into two big groups – perturbations created by the scene objects (objects, seen in the Objects Tree) and perturbations created by the objects scattered in areas. Perturbations also differ by their types. There are four types of perturbations: Circular Waves for Dropped, For Oblong Dropped, Waves for Static Object and Cavity.

To add any kind of external perturbation to the river surface select River_0 in the Objects Tree and then click at External Perturbations in the Properties Tree. The External Perturbations dialog appears in the bottom window of the Properties Editor.



External Perturbations dialog

External Perturbations list

Click at the small green cross at the dialog's toolbar. A list of possible External Perturbations appears. Select Circular Waves for Dropped and click OK. The selected External Perturbation is added to the river.

Circular Waves for Dropped.

Add this kind of perturbation to the river surface if you want to get running circular waves from a stone thrown to the water.

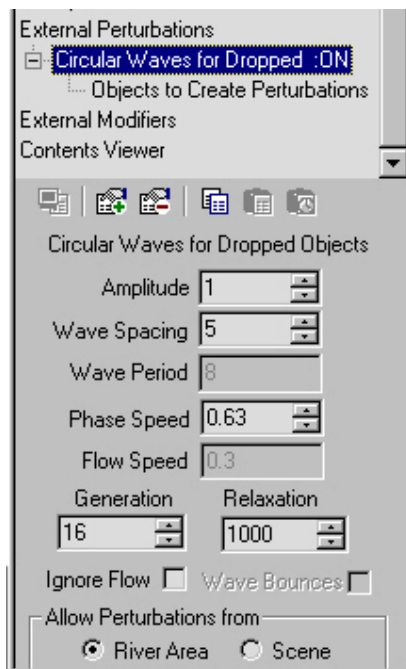
First of all we need an animated stone in the scene. For the sake of simplicity we will take a ready object from a library. Make a right click in the library window and choose Open in the pop-up menu appeared. Open RiverTutor.odt library which is supplied with this document. RiverTutor library is loaded to the library window. In the left sub-window select animated stones sub-branch. A number of icons appears in

the right sub-window. In the right sub-window select stone5, catch it by pressing the left mouse button, drag the object to the Objects Tree (it is important!) and drop it to the Scene in the Objects Tree. The stone is stored in the library with its animated position and thus appears at the right location in the Scene. Moving the frames scroll bar at the bottom of the screen in the range from 0 to 13 frames

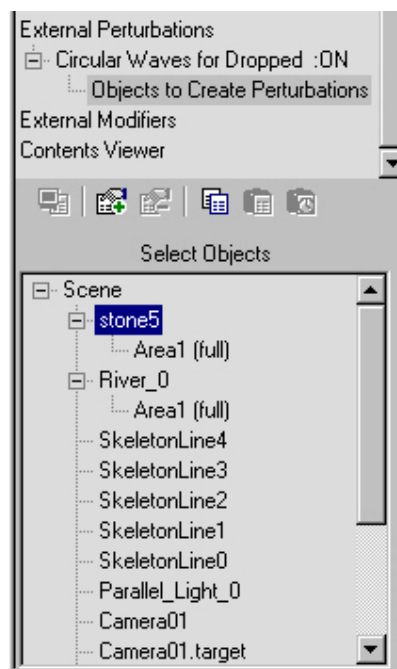


make sure the stone is animated and is well seen in the Camera01 viewport since the fourth frame.

When Circular Waves for Dropped is added to the river the string of the same name appears as a sub-branch of External Perturbations in the Properties Tree. Circular Waves dialog appears in the bottom window of the Properties Editor (see pictures below).



Circular Waves dialog



Objects to Create Perturbations dialog

Let us set parameters to this dialog beginning from its bottom. We are interested for perturbations from scene objects so that we need check Allow Perturbations from Scene.

Generation (in frames) means for how long time the waves will be emanated from the point where the stone intersects the river surface at first. Set this parameter to 30. In our case the stone intersects the river surface at the 9-th frame. Thus the waves will be generated since 9-th up to 39-th frames.

Phase Speed - is the speed at which waves propagate in a still water (units / frame). Set this parameter to 0.3. Note that the grayed out Flow Speed reads 0.2. This is an information line showing you the low limit of the Phase Speed. Until “Ignore Flow” is not checked, the perturbations with the Phase Speed less than Flow Speed will have no effect.

Wave Spacing - is the distance (in the radial direction) between two sequential waves. It should be not less than $5 * \text{Mesh Step}$ (see River Mesh Settings dialog in River Parameters section) to provide good waves resolution. In our case Mesh Step is equal to 0.5, so that 5 units is a proper value for Wave Spacing.

Wave Period – is informational control. This parameter depends on both Wave Spacing and Phase Speed. It is used to fit Generation. For example, in our case this line reads 10 (frames) and Generation was set to 30 (frames). We can conclude that 3 circular waves ($30 / 10 = 3$) will be generated during our generation period.

Amplitude – is the maximal height of the perturbation (very close to the emanation point). Let us set the amplitude to 0.7.

This is all with Circular Waves for Dropped dialog up to now.

In the Properties Tree click at External Perturbations / Circular Waves for Dropped / Objects to Create Perturbations and select stone5 in the list of objects appeared (see the right panel of the figure above). This action tells WB what objects to create perturbations from.

Tips: 1. When you animate an object to create river perturbations, pay attention to the following. There must be *at least a single frame* when the object intersects the river surface. Otherwise World Builder will be unable to catch the start moment of waves generation. For example, suppose your stone size is 1 unit, the river surface is located at $z = 0$ in the world c.s. If at frame 10 the z-coordinate of the stone is +3 units, and at frame 11 the same coordinate is -3 units, WB cannot fix the moment of the stone and river intersection. No waves will be produced.

2. Do not set very high values to Amplitude. Remember that waves are much better seen in animation than in static pictures. Too large perturbations look grotesquely in a movie.


Render a number of frames or make a movie as described in How to Make a Movie section. The ready movie is stored in **Movies/part2_1.avi**.

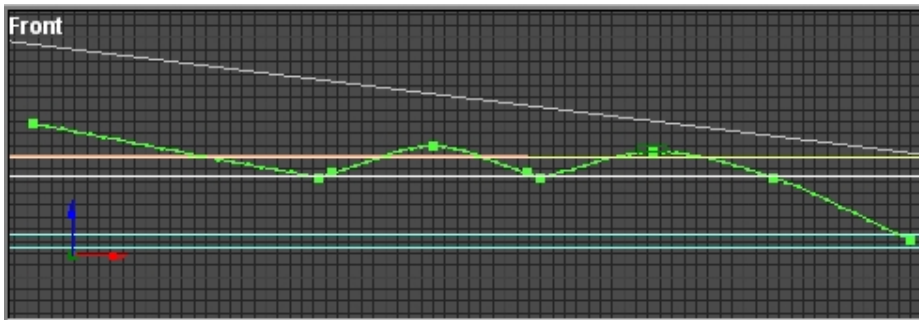
The results of the latest step are stored in **Projects/RiverPart2_1.awb**.

For Oblong Dropped

Add this kind of perturbation to the river surface if you want to get running waves in the following situations. First, to get waves from an oblong object, say, a tree fallen to the river. Second, to get waves from an object, which intersects the water surface several times and in different locations.

Let us consider an example. Suppose, you have thrown a flat stone nearly parallel to the river, so that it rebounds several times from the river surface, making circular waves at those points where it faces the surface. World Builder allows us to simulate this experiment.

As in the previous example, we need a stone flat as a pancake. In the library window make a right click and choose “Open” in the pop-up menu appeared. Open RiverTutor.odt library, which is supplied with this document, select animated stones in the left library sub-window. The icons representing the objects appear in the right sub-window of the library window. Select “pancake” and drag / drop it to the Scene in the Objects Tree. The animated stone is added to the scene. If you select the pancake and then click the Trajectory Editor ( button at the main toolbar) you can see the trajectory of the stone in the front view:



Here the white horizontal line is the river level. Its well seen that the pancake intersects the river surface three times (in frames 20, 40, 60). To hide the trajectory click the Trajectory Editor once again.



Rivers Tutor library

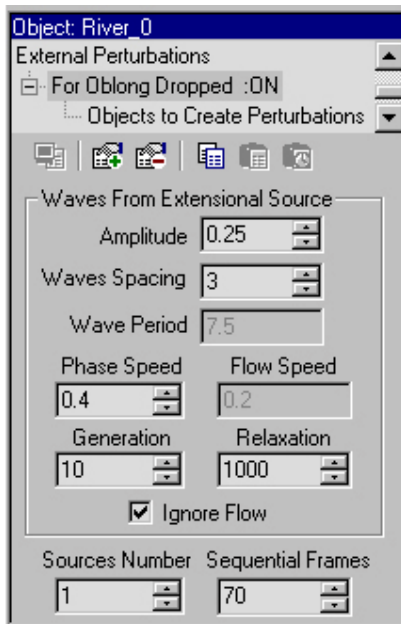
Add the For Oblong Dropped perturbation as described in External Perturbations section. The For Oblong Dropped dialog appears at the bottom window of the Properties Editor (see below).

First of all let us select the pancake in the “Objects to Create Perturbations” list using Objects to Create Perturbationa dialog. When you then come back to the For Oblong Dropped dialog, you will find that it is very similar to the Circular Waves dialog except two additional controls. It seems to be very clear because the waves from an oblong object consist of a number of circular waves, which interfere with each other.

Set the Amplitude to 0.25. It is less than that in the previous example, because a number of interfering waves produce greater perturbations.

Set the Waves Spacing to 3. As mentioned above, it is quite sufficient for a good waves resolution (the mesh step is 0.5 as River Mesh Settings dialog says).

Let the Phase Speed be 0.4 units, and the Generation - 10 frames. If we set the latter parameter to a greater value, there will be an odd impression of waves generation long after the pancake has left the point of the contact with water.



For Oblong Dropped dialog

Check Ignore flow to prohibit waves shift by the flow. By the way, it will help us to see the difference between the waves behaviour in this and the previous example.

Now consider the rest two parameters, which were absent in the Circular Waves dialog.

Sources Number – so many ordinary point wave sources are placed to the region where the object intersects the water surface. Let this number to be 1, as our stone is not oblong.

Sequential Frames – for so many frames WB follows the animation of the stone computing locations of its intersection with the water surface. Set it to 70 for our pancake's animation lasts 70 frames.

Well, all is ready for a new movie. **Tip:** Do not forget to remove the old stone5 from the scene and Circular Waves for Dropped from River_0's properties. Or else the perturbations will be superimposed.

Render a number of frames or make a movie as described in How to Make a Movie section. The ready movie is stored in **Movies/part2_2.avi**.

The results of the latest step are stored in **Porjects/RiverPart2_2.awb**.