Miniature Man-made Whitewater River

Background of the Invention

The invention refers to a **Miniature Man-made Whitewater River 100** to serve as a whitewater rafting facility.

The sport, whitewater rafting, is an adrenaline pumping and fun-filled activity. It is about team work; hence it is a popular family sport since it promotes family bonding. However, a certain degree of skills is required to navigate the raft through turbulent waters safely, since natural whitewater rivers are often unpredictable. A whitewater rafting trip usually last from one to several days and even weeks.

To incorporate the element of safety in this sport, artificial whitewater rivers have been created around the world. Examples include the U.S National Whitewater Centre (USNWC) located on the banks of the Catawba River in Charlotte, N.C., which is also the world's largest artificial whitewater river and an official U.S. Olympic Training Site, and also the Penrith Whitewater Stadium near Sydney, Australia. Such centers marry the popularity of the sport with the safety that so many curious adventurers crave. This is so as in an event of emergency, the Whitewater River can be turned off.

However, these existing artificial whitewater rivers are built over a sprawling land area, which can only be available on the outskirts of cities or in the countryside. As such, to bring the fun and excitement into cities as well, where land space is scarce and costly, the concept of the **Miniature Man-made Whitewater River 100** is a constructive and novel invention. A raft ride on the **Miniature Man-made Whitewater River 100** will definitely satisfy the adrenaline-thirst of the city dwellers right at their doorsteps. And for those who do not have much time to spare, 20 minutes is all that is needed to enjoy an experience that is similar to that of the real thing.

Summary of the Invention

The **Miniature Man-made Whitewater River 100** is designed such that it can be built on a small piece elevated land that slopes down, with a gradient of around 300m/km to serve as a whitewater rafting facility. This makes it suitable to be implemented on built-up areas like cities, where land space is limited and very costly. The overview of the **Miniature Man-made Whitewater River 100** is shown in **Figure 1**.

The elevated land sloping down will be terraced, to create horizontal platforms to reduce the gradient of the slope gradually. In addition, by terracing the landscape, the entire length of the river will be increased.

The horizontal platforms then serve as channels to contain water forming the course of the **Miniature Man-made Whitewater River 100**. Each platform will slope downwards **201**(**Figure 2**) with a smaller gradient. Abrupt descents link one platform to the next, and are a necessary feature of Whitewater Rafting to bring the whole course of the **Miniature Man-made Whitewater River 100** from the peak to reach the bottom given the height of the elevated land. The course of the **Miniature Man-made Whitewater River 100** is as shown in **Figure 3**.

The width of the river varies over its course to create narrowing and widening paths. The width of the path at the abrupt descents can be widened to reduce the speed of the water in those areas. The entire **Miniature Man-made Whitewater River 100** is around 500-1000m in length. This translates to a raft ride that would last for around 5 to 10 minutes.

There will be a huge finishing pool **107** at the bottom of the **Miniature Man-made Whitewater River 100**. This huge pool stores the water that is released down from the course of the **Miniature Man-made Whitewater River 100** and also acts as a recreation pool.

Finally, there will be various obstacles incorporated in the **Miniature Man-made Whitewater River 100**, such as rapids and waves, to make this whitewater rafting experience as life-like as possible.

Brief Descriptions of the Drawings

Embodiments of the invention are described hereinafter with reference to the following drawing in which:

Fig.1 shows the perspective view of the concept of the **Miniature Man-made Whitewater River 100**

Fig.2 shows the perspective view of the platforms sloping downwards

Fig.3 shows the perspective view of the course of the **Miniature Man-made Whitewater River 100**

Fig.4 shows the side profile of an abrupt descent

Fig.5 shows the side profile of the original plot of land

Detailed Description of the Invention

A **Miniature Man-made Whitewater River 100** is to be constructed on a 10,000-50,000m^2 piece of elevated land that slopes down, to serve as a whitewater rafting facility. The elevation of the slope is at least 30m high and corresponding a gradient of around 300m/km depending on the actual size and elevation of the land.

In highly urbanized areas e.g. cities where land is very limited and scarce, only a small piece of land can be allocated to the man-made Whitewater River. Unlike places like countryside where there is an abundance of empty land space, a man-made whitewater river can span an area of 1000000m^2. An example would be the U.S National Whitewater Centre (USNWC) located on the banks of the Catawba River in Charlotte,

N.C., which is also the world's largest artificial whitewater river and an official U.S. Olympic Training Site. However, this **Miniature Man-made Whitewater River 100** will only occupy an area of 10000-50000m^2, an area which is about 50 times smaller than that of existing ones. Hence, this concept is exceptionally useful and practical for built-up areas where land is scarce and costly.

The land with an elevation of at least 30m will allow the **Miniature Man-made Whitewater River 100** to be built over such a small land area. Existing artificial whitewater rivers are built on relatively flat areas, e.g. flood plain, as that of Penrith Whitewater Stadium near Sydney, Australia, and normally consist of two pools, one high and one low, surrounded by channels of water. The flat land is then built up and landscaped to provide the necessary drop and slope.

However, by building on a piece of elevated land that slopes down, the descents and slopes are already present naturally. In addition, instead of flattening the land and supporting the unused elevated land to prevent land slide which is not cost-efficient, the course of the **Miniature Man-made Whitewater River 100** is based building upon the slope.

As seen in **Figure 1**, the slope will be terraced to provide a series of platforms, each rising above the other, hence giving a stepped appearance. Each platform slopes downwards **201** as shown in **Figure 2**, to create a more gradual gradient. There will be abrupt descents such as **102** and **103** at the ends of each platform, linking one platform to the next. Each platform is then designed and made into channels (**104**) to contain water, thus forming the course of the **Miniature Man-made Whitewater River 100**. The raft ride **301** as seen in **Figure 3** will begin at the peak, navigates through each platform passing through the abrupt descents such as **102** and **103** and ultimately reaches the bottom. Navigating the course in a zigzag fashion is similar to how skiers ski down from a mountain top to cushion the descent. By doing so in this case, it drastically increases the length of the **Miniature Man-made Whitewater River 100** multiple times, thus lengthening the raft ride which is essential given such a small piece of land as well as reducing the gradient of descent.

Depending on the height of the peak, the abrupt descents such as **102** and **103** at the ends of each platform have to be significantly huge in order for the whole course of the **Miniature Man-made Whitewater River 100** to reach the bottom. As such they are angled slopes as shown in **Figure 4**, rather than sharp, sudden falls to cushion the fall which might otherwise compromise the safety of the rafters. These abrupt descents, besides being one of the necessary features of rafting, also serve to maintain the fast speed of the flowing water. Each descent can be over 2m to 10m or more in height.

Due to the great drop in the abrupt descent such as **102** and **103** of the **Miniature Man-made Whitewater River 100,** lesser amount of water flow would be required to create the high velocity of a typical class II-IV river that have water flow of about 14 m^3/s. As such, a lower flow-rate pump is needed making it more cost effective to construct.

Similarly with the platforms sloping downwards **201** (**Figure 2**), they create a much bigger gradient as compare to natural whitewater river, hence the depth of water will be much lower in a given width of the river, to about 0.3-0.5m as compare to lower gradient natural whitewater river that can accumulate water to a depth of above 0.5m. Again, the overall volume of water required by the **Miniature Man-made Whitewater River 100** is lesser; hence a lower flow-rate pump is needed.

The width of the course can vary from 3m (**105)** to 15m (**106**). As such, narrowing and widening paths are created which makes it more challenging for the rafter to navigate in different water flow conditions. The zigzag fashion of the **Miniature Man-made Whitewater River 100** course from the peak to the bottom also creates bends in the path of creating different water flow conditions.

As for the abrupt descents e.g. **102** and **103,** to further cushion the drop if the descent is still huge even with angled slopes as mention earlier, it can be designed to have a wider width to reduce the speed of water in those areas thus reducing the impact and force of the water on the rafters. The entire **Miniature Man-made Whitewater River 100** is around 500-1000m in length. This translates to a raft ride that would last for

around 5 to 10 minutes. Therefore, the **Miniature Man-made Whitewater River 100** is designed to provide a short but adrenaline pumping and fun-filled experience.

The gradient of a natural whitewater river ranges from 5-50m/km.Depending on the size of the land, if the piece of elevated land were to be left un-terraced, the length of the Whitewater River would only be around 100-200m (**Figure 5**) flowing directly down. With an elevation of 30-60m, a direct downward slope will have an average gradient of 300m/km, which is way too steep for amateur rafters to navigate. However, upon terracing, the length of the **Miniature Man-made Whitewater River 100** would be increased to 500-1000m as shown in **Figure 3**; hence the average gradient would be significantly reduced to an average of 60m/km. To further reduce the gradient, while each platform slopes downwards gradually **201** (**Figure 2**), there will be abrupt descents such as **102** and **103** at the ends of each platform (as mentioned and elaborated on earlier). In addition, these descents and slopes also decrease the volume of water required to fill the **Miniature Man-made Whitewater River 100**.

There will be a huge finishing pool **107** at the bottom of the **Miniature Man-made Whitewater River 100**. This huge pool stores the water that is released down from the course of the **Miniature Man-made Whitewater River 100**, and omits the need of having water tanks just to store the water, hence saving space. Powerful pumps then pump the water back up to the start of the river at the top **101**. This huge finishing pool is also a recreation pool, whereby rafters can relax and have a rest after the raft ride.

As mentioned earlier, the abrupt descent is one of the necessary components of whitewater rafting. They can be likened to small-scaled waterfalls (**103**) found in natural whitewater rivers, which pose as an obstacle to the rafters. Other obstacles include rapids, tongues, holes, turbulence (e.g. eddy currents), waves and river bends. The course can be landscaped to create such features, with the incorporation of boulders or ledge, rocks and ramps (**108**). These obstacles serve to mimic the characteristics of a natural whitewater river, therefore making the raft ride much more challenging and exciting, just like that of the real sport. In addition, the obstacles are not fixed permanently and thus can be used for varying the difficulty of the course and

for fine-tuning of the rapids by re-arranging them. Overall, the **Miniature Man-made Whitewater River 100** can be constructed on different heights of elevated lands that slope down. With the features of the terrace and abrupt descent together with the ability to control the level of water flow by varying the water flow of the water pump, different classes of River can be designed and constructed.