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(54) METHOD AND APPARATUS FOR A DRYWELL RETROFIT

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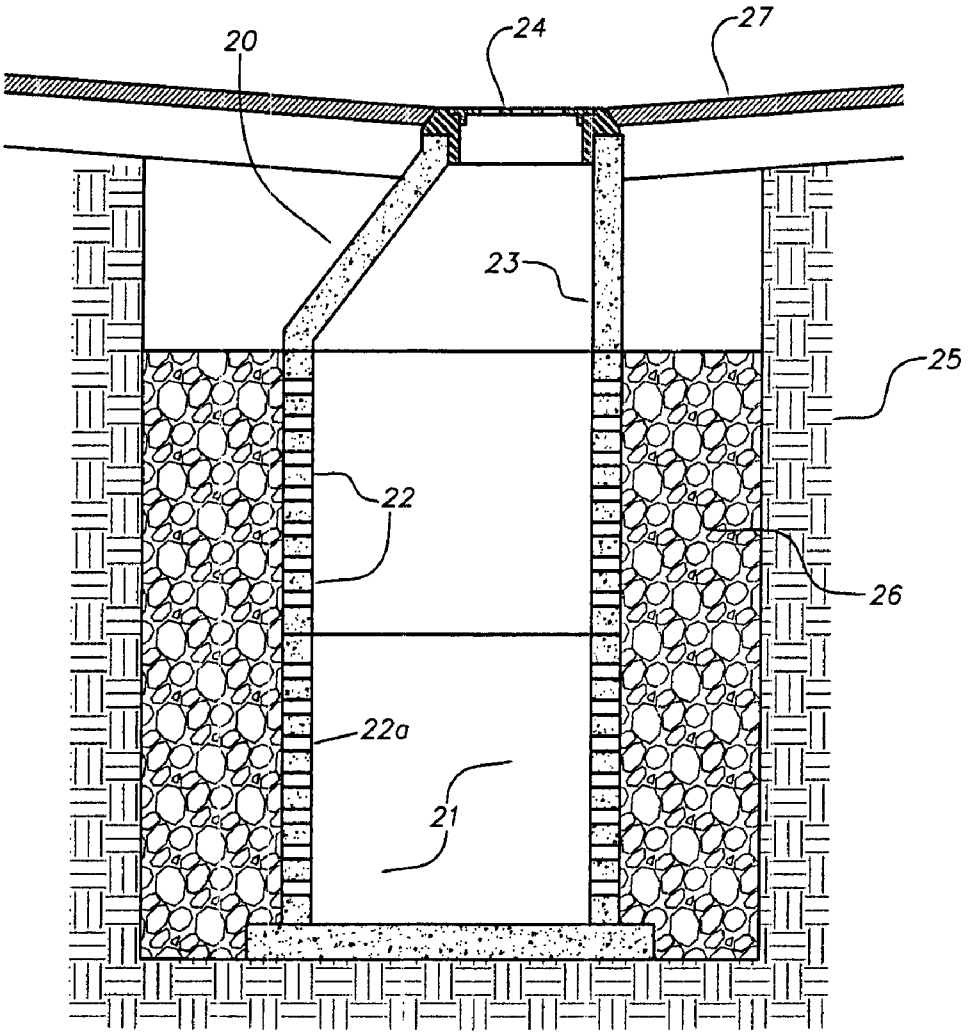
(57) **ABSTRACT**

The present invention is a drywell retrofit top that can either replace the top portion of an existing drywell or be placed upon a newly placed drywell. The drywell retrofit top provides a flow path for storm water run-off from the top of the drywell directing the storm water run-off that falls into the drywell retrofit top trap chamber and then directs the water to a treatment system. After the treatment system process the water, the water is flows back to the drywell retrofit top to a drop chamber and then discharged into a drywell chamber where the water is able to percolate of filtrate back to surrounding native soils. The drywell retrofit top uses a precast concrete cylinder that has an integral bottom piece that is placed on top of a perforated precast concrete cylinder from the previous drywell. The drywell retrofit top has a vertical dividing wall separating the precast concrete cylinder into two chambers with a larger chamber collecting the storm water run-off. While the water is collected, sediment and heavier than water pollutants settle out in the trap chamber. An outlet pipe is place several inches or some way up the side wall of the drywell retrofit top cylinder. Once the water reaches the level of the outlet pipe, the water then flows out of the trap chamber to a treatment system that is typically situated near the drywell.



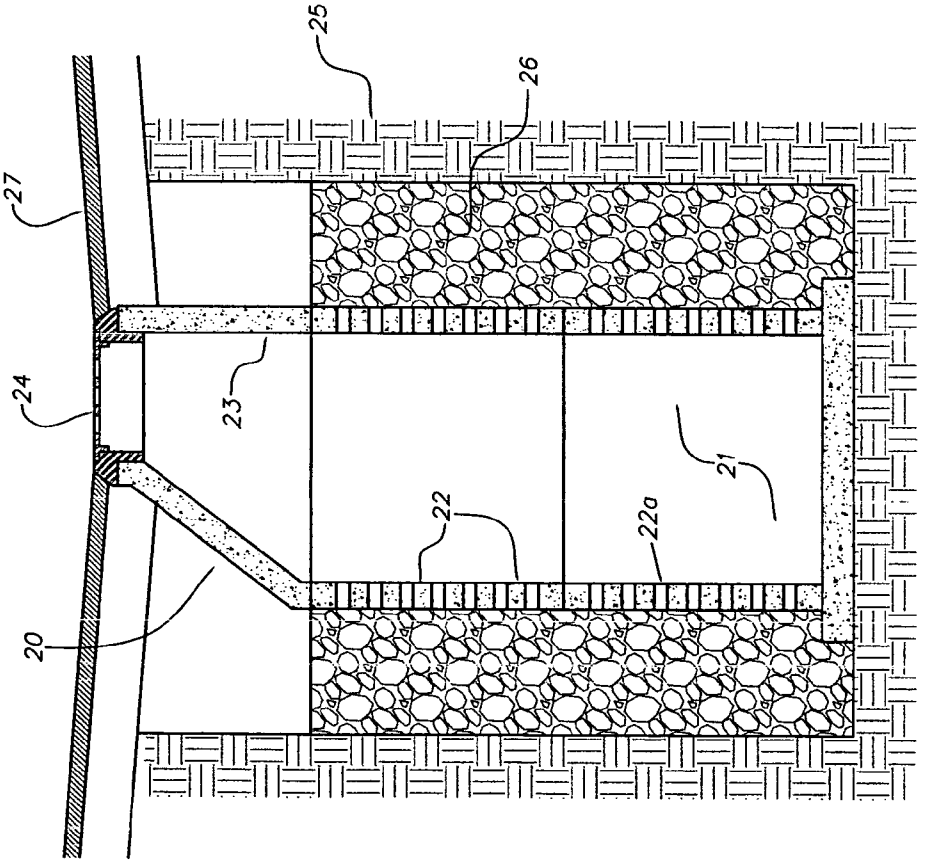
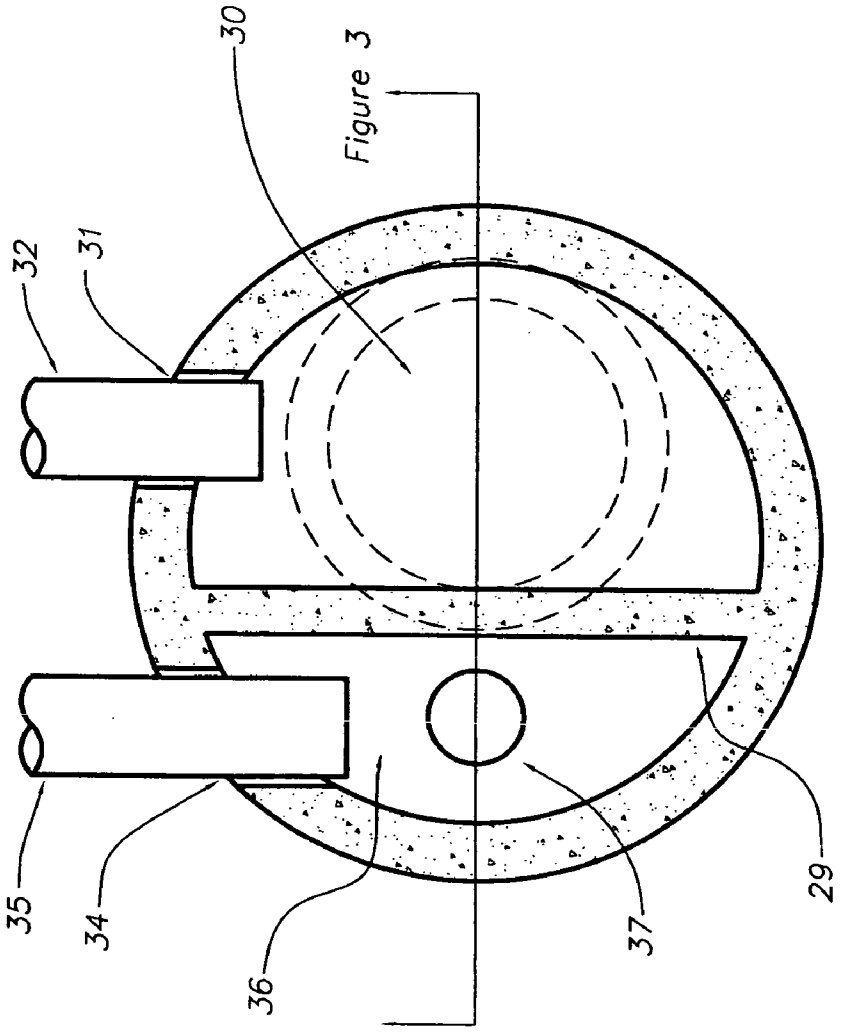


Figure 1

Figure 2



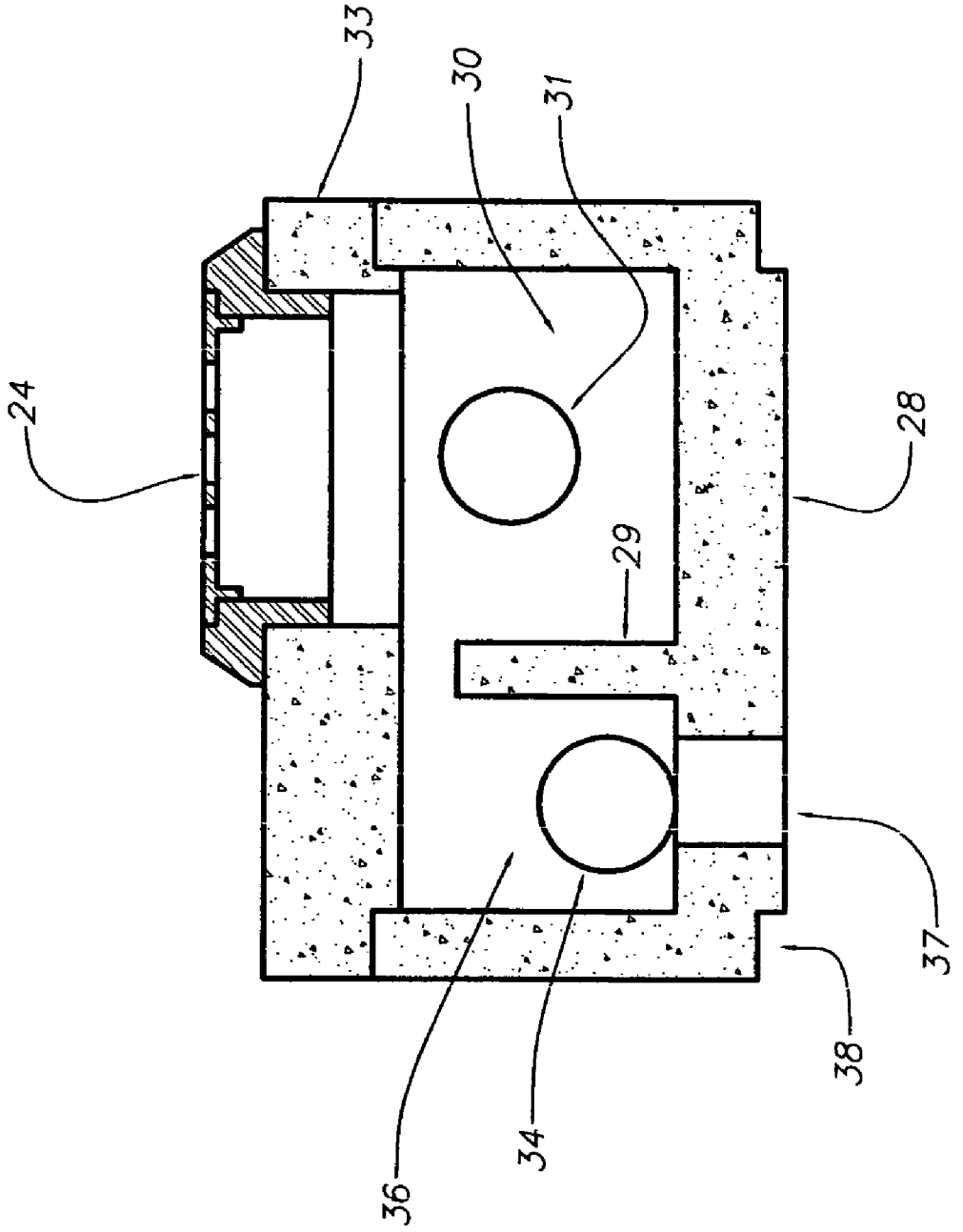
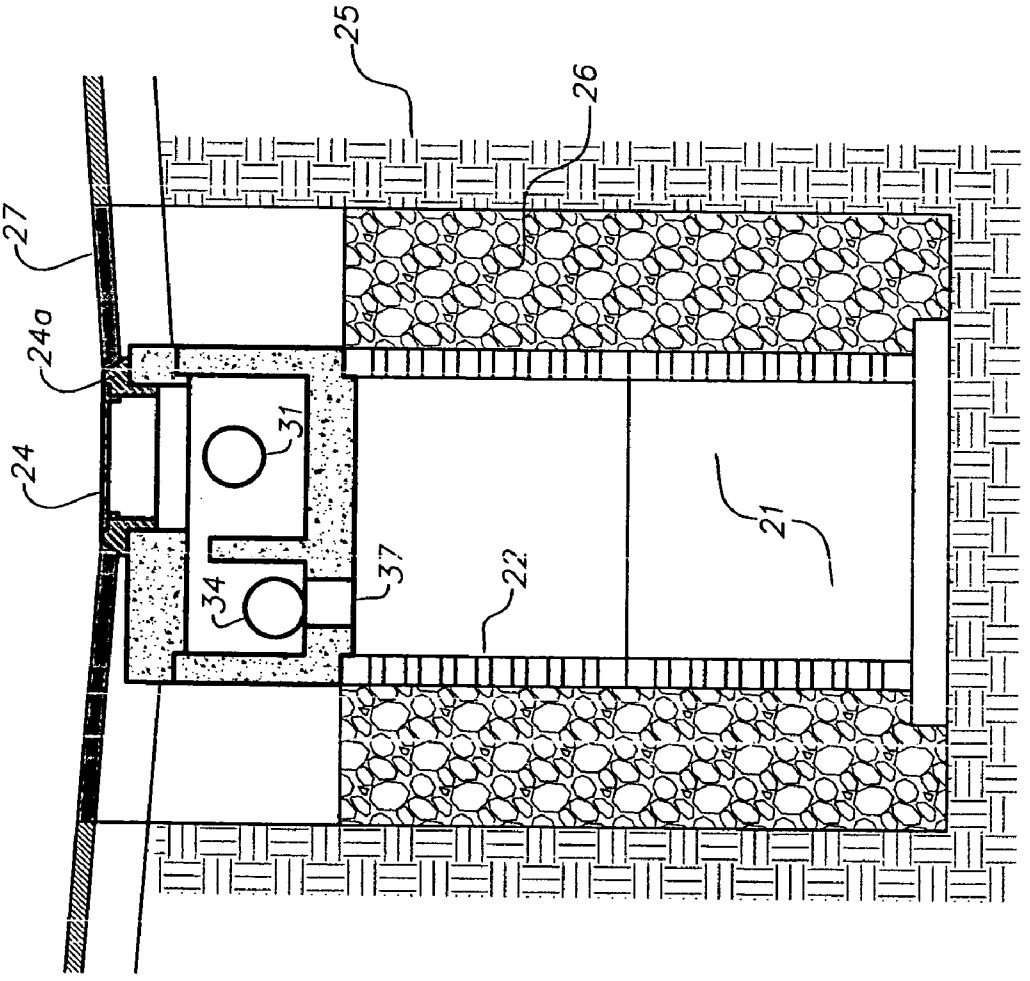


Figure 3

Figure 4



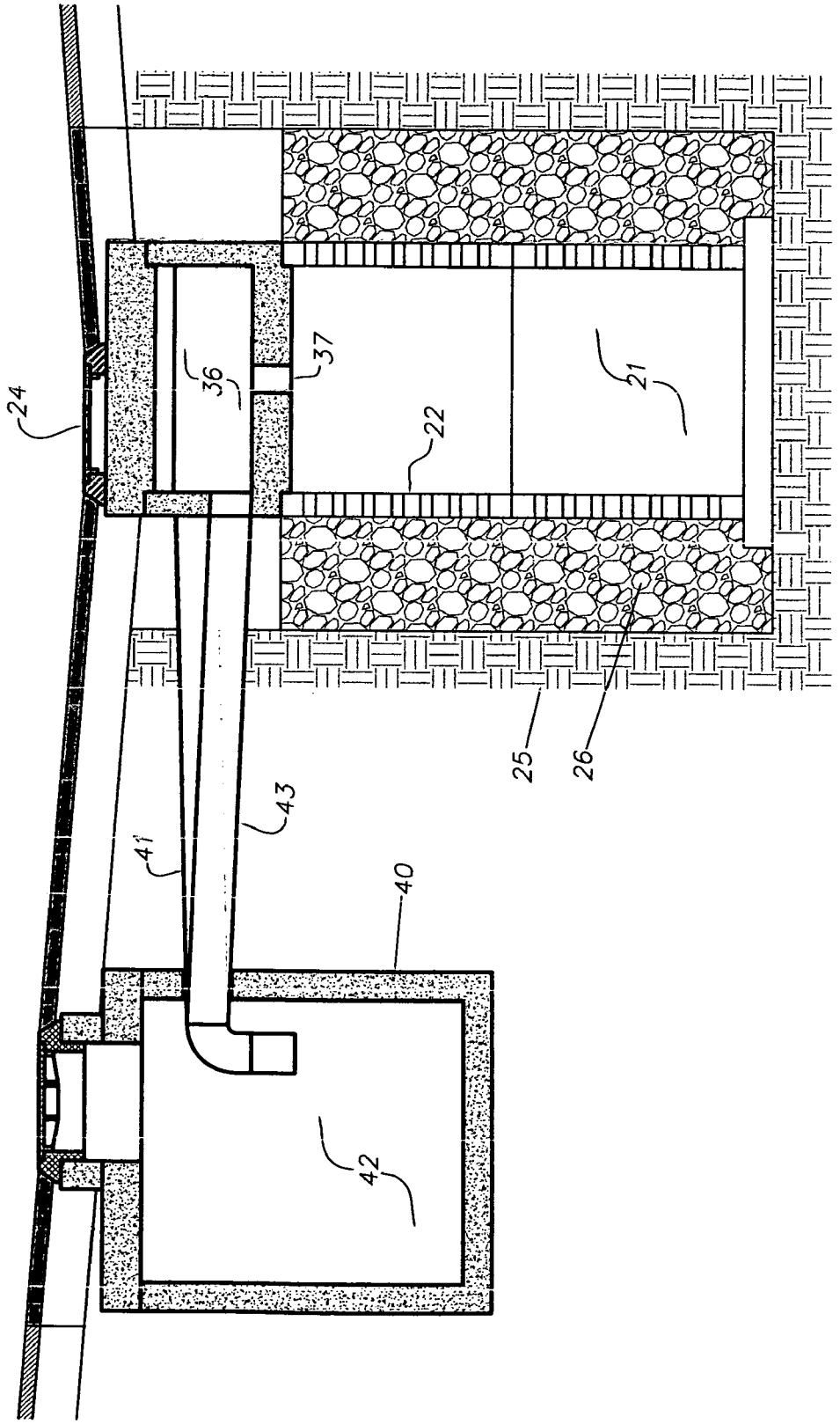


Figure 5

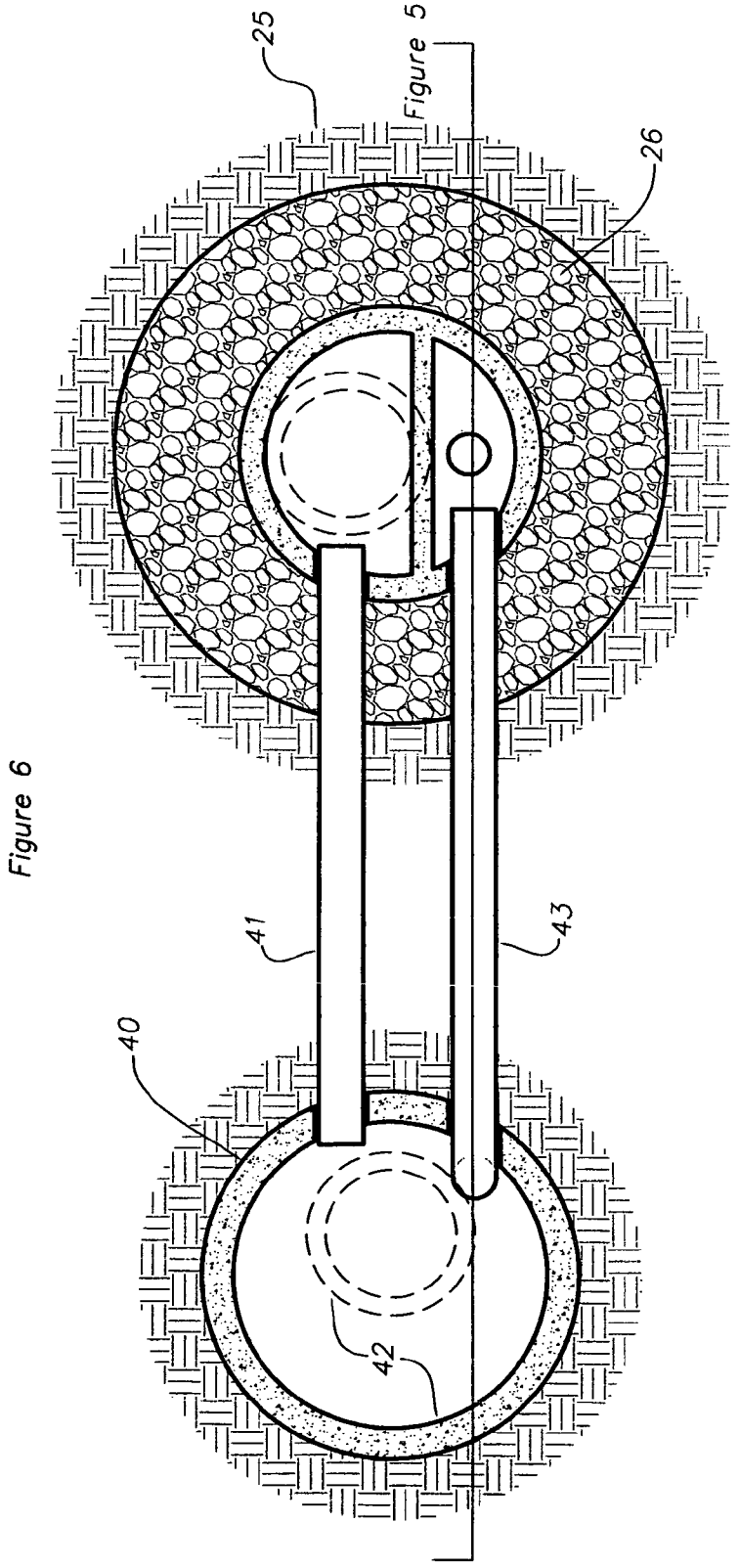


Figure 5

Figure 6

METHOD AND APPARATUS FOR A DRYWELL RETROFIT

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] None

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] None

BACKGROUND OF THE INVENTION

[0003] In many parts of the country, there are no municipal storm sewer systems to convey storm water from a developed property to natural water bodies, including groundwater. In these areas without storm sewers, drywells are often used for the localized disposal of collected storm water from public roadways and private properties. Typically, these drywells are constructed of various products and materials, but almost all employ some kind of perforated tank or chamber which is installed underground in an excavated hole and backfilled with rocks or clean gravel or a combination of rock and gravel

[0004] Typically, storm water from roof tops and paved areas is directed to the drywell through a grated opening or via underground pipes. The storm water in the chamber then percolates through the perforations in the chamber, through the voids between the backfill rock, and into the native soils and groundwater. This process is often times called infiltration.

[0005] Many such drywells receive polluted storm water that has not been treated before entering the drywell chamber. This polluted storm water is then infiltrated into the native soils and recharges the groundwater, potentially contaminating local drinking water supplies. Some of the common pollutants in roadway and parking lot runoff are oil, grease, and heavy metals. Fertilizers and pesticides from landscaped areas can also be washed into these drywell systems and eventually end up in the drinking water supply. In addition to the groundwater contamination issue, any silt and sand washed into a drywell will settle out of the storm water and collect in the bottom of the chamber. Over time the function of the drywell can be impeded and eventually cease altogether if the pores in the adjacent native soils are plugged with silt. This failure of the drywell can result in localized flooding and property damage.

[0006] Governmental control and regulation of drywells has evolved with an increased understanding of groundwater contamination and potential environmental impact of pollutants injected into the ground through drywells. The U.S. Environmental Protection Agency (USEPA) regulates groundwater injection wells, which include drywells, under the auspices of the federal Safe Drinking Water Act in order to limit and control the injection of waste fluids in a manner that protects existing groundwater quality. In many states, the USEPA has delegated administration of an Underground Injection Control (UIC) program to state environmental agencies. Since 2000 the EPA has required that all new and existing groundwater injection wells be inventoried and registered.

[0007] Additionally, since 2001 new and existing injection wells are required to be authorized by rule, commonly known as Rule Authorization. Rule Authorization is a general permit issued by the State which carries with it a set of prescriptive requirements. One of the primary requirements for rule authorization of drywells and other Class V storm water injection wells is that the injection systems must be designed and constructed to prevent storm water contamination and remove pollutants including petroleum products, metals, fertilizers, pesticides, herbicides; fecal coli form bacteria and animal waste. The Federal Safe Water Drinking Act has no "grandfather" clause. Therefore, owners and operators of UIC systems without Rule Authorization may not be in compliance with federal regulations, regardless of when the UIC was constructed. The proposed invention facilitates the retrofit of certain drywell UIC's such that the flow of polluted storm water can be intercepted and diverted for treatment prior to underground injection.

[0008] Drywells are often times constructed using a pair of perforated, precast concrete cylinders stacked vertically and topped with a precast concrete cone, and steel manhole lid. The perforated cylinders are typically four feet tall and four feet in diameter. The precast concrete cone is three feet tall and the diameter tapers from four feet at the bottom to two feet at the top. This form of drywell is created by first excavating a hole in the native soils to a depth such that the elevation of the steel manhole lid will match the finish pavement surface when site development work is completed. The two cylinder sections are stacked in the excavated hole on a concrete foundation, the cone with steel manhole lid is placed on top of the stacked cylinders, and the excavated hole is backfilled with rock.

[0009] Typically the location of the drywell is such that the drywell will be suited for the collection of the storm water runoff. To assist this process, the finish pavement surface is usually graded such that the drywell is at the localized low point and a grated manhole lid is used to facilitate the collection of storm water into the drywell. The storm water then sheet flows across the pavement to the low point and enters the top of the drywell through the grated steel lid. This storm water flows directly into the drywell chamber, through the perforated holes of the concrete cylinders, through the drain rock and into the native soils with all the pollutants and contaminants that it may have accumulated as it flowed across the pavement surface.

[0010] One of the objects of this invention is to create an efficient means to retrofit existing drywells that do not have a system for removing sediment, oils and other pollutants from the storm water prior to collection and infiltration with minimal disruption of the existing paved areas. The present invention is meant to replace a portion of an existing drywell without the complete removal and replacement of the existing drywell and all of the cost associated with such a removal.

[0011] Another objective of the present invention is to provide a means to remove sediment and heavier than water material from storm water run-off prior to the storm water entering the drywell chamber. By removing the sediment and heavier than water pollutants from the storm water, the drywell chamber perforations will be less likely to become clogged and therefore more efficient over an extended length of time.

[0012] Another objective of the present invention is to allow one to use one of several means for treating storm water prior to entry into the drywell chamber. While the present invention does not make an independent claim for a treatment system, the present invention provides a means to trap the polluted water and divert it to an appropriate treatment

mechanism. The present invention then receives the treated water and directs it into the drywell chamber for infiltration into the native soil.

BRIEF SUMMARY OF THE INVENTION

[0013] The present invention is a drywell retrofit top that can replace the top portion of an existing drywell. The drywell retrofit top provides a flow path for storm water run-off from the top of the drywell directing the storm water run-off that falls into the drywell retrofit top trap chamber and then directs the water to a treatment system. After the treatment system processes the water, the water flows back to the drywell retrofit top to a drop chamber and then discharged into a drywell chamber where the water is able to percolate to surrounding native soils. The drywell retrofit top uses a precast concrete cylinder that has an integral bottom piece that is placed on top of a perforated precast concrete cylinder from the previous drywell. The drywell retrofit top has a vertical dividing wall separating the precast concrete cylinder into two chambers with a larger chamber collecting the storm water run-off. While the water is collected, sediment and heavier than water pollutants settle out in the trap chamber. An outlet pipe is place several inches or some way up the side wall of the drywell retrofit top cylinder. Once the water reaches the level of the outlet pipe, the water then flows out of the trap chamber to a treatment system that is typically situated near the drywell.

[0014] There are numerous treatment systems that could be employed to process the storm water run-off and then once the water has been processed, the water is returned to the drywell retrofit top to the smaller drop chamber by means of and inlet pipe. The water flows from the drop chamber through a drain hole of the integral bottom of the drywell retrofit top and into the drywell chamber to pass through the perforated holes of the perforated precast concrete cylinders of the drywell.

[0015] Flow of storm water from the trap chamber to the treatment system and back to the drop chamber is accomplished by gravity through the placement of the outlet and inlet pipes and the placement of the treatment system. One embodiment of the treatment system incorporated with the drywell retrofit top is described.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWING

[0016] FIG. **1** is a cross sectional view of a drywell.

[0017] FIG. **2** is a plan view of the drywell retrofit top;

[0018] FIG. **3** is section view of the present invention; and

[0019] FIG. **4** is a section view of a drywell after it has been retrofitted with the present invention.

[0020] FIG. **5** is a cross sectional side view of the drywell with the drywell retrofit top connected to a treatment system.

[0021] FIG. **6** is a top plan view of the drywell retrofit top and a connected treatment system.

DETAILED DESCRIPTION OF THE INVENTION

[0022] Various embodiments of the methods and apparatus will now be described. The following descriptions provide specific details for a thorough understanding and enabling description of these embodiments. It should be noted, however, that the above "Background" describes technologies that may enable aspects and embodiments of the invention. One skilled in the relevant arts will understand, however, that the invention may be practiced without many of these details. Additionally, some well-known structures or functions may not be shown or described in detail, so as to avoid unnecessarily obscuring the relevant description of the various aspects and embodiments of the invention.

[0023] The terminology used in the description presented below is intended to be interpreted in its broadest reasonable manner, even though it is being used in conjunction with a detailed description of certain specific embodiments of the invention. Certain terms may even be emphasized herein; however, any terminology intended to be interpreted in any restricted manner will be overly and specifically defined as such in this Detailed Description section.

[0024] Referring more particularly to the drawings, FIG. **1** shows a typical drywell **20** of the type to which this invention could be applied. The drywell chamber **21** is constructed of a pair of stacked perforated precast concrete cylinders **22** topped with a precast concrete cone **23** and a grated steel lid **24**. The precast concrete components have been placed in a hole excavated into the native soils **25** and backfilled with drain rock **26**. The adjacent paved surfaces **27** are typically constructed such that they are sloped causing storm water to run toward or drain directly into the drywell **20** through the grated steel lid **24**. Once storm water is collected into the drywell chamber **21** the water is discharged through the perforated holes **22***a* of the precast concrete cylinders **22**. The storm water is then infiltrated back into the native soils **25** through the drain rock **26**.

[0025] This particular invention is directed either toward retrofitting previously constructed drywells of the type described above that may have need for a system that can filter the storm water prior to being deposited in the drywell chamber **21** or to a new construction of a drywell that can incorporate all of the aspects of the claimed innovation. The precast concrete cone **23** is replaced with the present invention or the present invention is placed upon one or more new perforated precast concrete cylinders **22** as described above.

[0026] The present invention, a drywell retrofit diverter top **19**, is shown in FIGS. **2** and **3** with a top plan view of the device depicted in FIG. **2** and a cross sectional view of the device depicted in FIG. **3**. A side view of the drywell retrofit diverter top **19** on top of the perforated precast concrete cylinders. The drywell retrofit top is a precast concrete cylinder with an integral bottom **28** and a vertical dividing wall **29** separating the cylinder into two chambers of unequal size.

[0027] The larger of these two chambers is the trap chamber **30** with an outlet hole **31** for an outlet pipe **32**. Storm water or other run-off flows toward the drywell and enters the insert through a steel grated lid **24** that sits above the trap chamber **30**. As water flows across the surface **27** toward the drywell, it is not uncommon for the water to collect or pick up sediment, oils and other pollutants prior to entering into the trap chamber **30** through the grated steel lid **24** that sits above the trap chamber **30**.

[0028] When the storm water collects in the trap chamber **30**, the water level begins to rise and approach the level of the outlet pipe **32**. The outlet pipe is placed several inches above the top of the integral bottom **28**. By placing the outlet hole **31** and outlet pipe several inches above the top of the integral bottom **28** water falling into the trap chamber will collect allowing for sediment and pollutants that are heavier than water to settle out of the water prior to the water being discharged through the outlet pipe **32** and into the treatment system **40**. The sediment and material that is heavier than

water will collect at the bottom of the trap chamber **30**. The trap chamber is easily accessed by removing the grated steel lid **24** that sits in a manhole **33** at the top of the drywell retrofit top. By having easier access to the trap chamber **30** the sediment and heavier pollutants are more easily removed from the drywell and increase the longevity of the drywell.

[0029] Since the floor to the trap chamber **30** is several inches below the outlet pipe **32**, the trap chamber would provide a place for sand and pebbles to settle out of the storm water before it flowed into the treatment system. This removal of large particles prior to the treatment system would reduce the amount of maintenance required to keep the treatment system from clogging. The shallower drywell retrofit top is easier to access and clean than the deeper drywell.

[0030] Several problems commonly associated with sediment collection in the drywell chamber **21** are dealt with by removing the sediment in the trap chamber **30**. Over time excess sediment can clog the perforated holes **22***a* and reduce the efficiency of the infiltration system of the drywell **20**. Contaminants, including metals, pesticides, and phosphorous can attach to sediments and be carried into groundwater systems, leading to possible contamination. Finally, drywells that directly inject into underground sources of drinking water may have sediment levels that for hours or days render the water unfit for human consumption in nearby wells.

[0031] As the water rises in the trap chamber **30**, the water eventually reaches the level of the outlet pipe **32**. Water will flow into the outlet pipe and into a treatment system **40**. FIG. **5** depicts a type of treatment system **40** that could be employed with a typical drywell retrofit top. Other treatment systems could be employed or replaced with that shown in FIG. **5** and FIG. **5** only depicts one type of treatment system and one embodiment of the invention.

[0032] When water enters the treatment system as depicted in FIG. **5**, through a treatment system inlet pipe **41** that deposits the water into a treatment system chamber **42**. Sediments and other pollutants that are heavier than water that were not removed in the trap chamber **30** are allowed additional time to settle out of the storm water as the water fills the treatment system chamber **42**. As the water level rises, the runoff water and other material are transported out of the outlet hole **31** of the trap chamber **30** and into a treatment system **40** as depicted in FIG. **5**. The removal or separation of runoff water and any oils or hydrocarbons can be done any number of ways and those are known to those skilled in the art, such as a float system or baffle systems.

[0033] When the water rises to a sufficient height and the treatment system is removing the oil and other lighter than water pollutants, the water is able to flow out of the treatment system **40** through a treatment system outlet pipe **43** and toward the drywell retrofit top **20**, see FIG. **5**.

[0034] After the treatment system **40** is finished filtering the storm water and the storm water is able to flow out of the treatment system **40** through the treatment system outlet pipe **43**, the storm water returns to the drywell retrofit top **20** through an inlet hole **34** by means of an inlet pipe **35**, see FIGS. **2** and **3**. The inlet pipe directs and deposits the storm water into the smaller chamber of the divided drywell retrofit top **20** called the drop chamber **36**. A drain hole **37** is located in the integral bottom **28** of the drop chamber **36** for vertical discharge directly into the drywell chambers below, see FIG. **4**.

[0035] The exterior of the integral bottom **28** of the invention would be cast with a notch **38** to allow the drywell retrofit top to seat into place on top of the perforated precast concrete cylinders **22** for an easier retrofit of in place drywells, see FIGS. **3** and **4**.

[0036] In the drywell retrofit top, the outlet hole **31** for the outlet pipe **32** located in the trap chamber **30** would be placed vertically higher in the drywell retrofit top **19** sidewall than the inlet hole **34** and inlet pipe **35**. By placing the inlet pipe **35** below the outlet pipe **32**, the drywell retrofit top **19** is able to take advantage of gravity flow from the trap chamber **30** to the treatment system **40** and back to the drop chamber **36**.

[0037] Another embodiment of the present invention is lowering the top of the vertical dividing wall **29** to just below the underside of the flat top of the drywell retrofit top, seen in FIG. **3**. By placing a gap at the top of the dividing wall **29** between the trap chamber **30** and the drop chamber **36** allows for storm water to enter the drywell chamber in the event that the treatment system **40** or the outlet pipe **32** were to be plugged or unable to drain storm water collecting in the trap chamber. The storm water would bypass the treatment system **40** and flow over the top of the dividing wall **29** and directly into the drop chamber **36** and discharge into the drywell chamber **21** through the drain hole **37** in an emergency. This allows the drywell to continue to remove storm water runoff and avoid flooding or other water damage in the immediate area of the drywell.

[0038] FIGS. **4** and **5** show a completed installation of the drywell retrofit top **19** sitting on top of two perforated precast concrete cylinders **22**. In FIG. **4**, the outlet pipe **32** is connected to a treatment system **40** and in FIG. **5**; one embodiment of a treatment system is depicted.

[0039] The installation of the drywell retrofit top **19** would require: excavation of the pavement around the drywell grated steel lid **24**; removing the grated steel lid **24** and steel frame **24**; accessing and removing the precast concrete cone **23**; placing the drywell retrofit top **19** on top of the perforated precast concrete cylinders **22**; hooking up the outlet pipe **32** to a treatment system **40**; and the outlet pipe of the treatment system **43** to the inlet pipe **34** of the drop chamber **36**. The placement and setting of the outlet **32** and inlet **35** pipes needs to be made such that the water is directed from the trap chamber **30** to the treatment system **40** to the drop chamber **36** by gravity flow.

[0040] The steel frame **24***a* and grated steel lid **24** could be salvaged from the precast concrete cone **23** for reinstallation on the drywell retrofit top **19**. Once the drywell retrofit top **19** is in place and the outlet **32** and inlet **35** pipes are hooked up to the treatment system **40**, the backfill material removed around the precast concrete cone **23** is returned and the sloped pavement **27** is rebuilt.

[0041] Another embodiment of the present invention is to place an access hole in the concrete cover above the drop chamber to allow for the withdrawal and sampling of storm water runoff either in the drop chamber or in the drywell chamber through the drain hole.

[0042] In the preferred embodiment, precast concrete forms will be used for the construction of the various components of the drywell retrofit apparatus, however, other materials known to those skilled in the art are capable of being used for the various components of the drywell retrofit apparatus, such as steel, hard plastics or a combination of materials. Precast concrete is the preferred material due to cost and fabrication considerations.

I claim:

1. A drywell retrofit diverter top comprising;

a precast concrete vessel having an integral bottom, a trap chamber, a drop chamber with the two chambers being separated by a vertical dividing wall that sits upon the integral bottom;

a precast concrete cover that integrates with the precast concrete vessel and sits above the trap and drop chambers with a manhole and a grated top to direct storm water runoff to drain into the trap chamber;

the trap chamber having an outlet hole in which storm water runoff is directed to a treatment system;

a return line from the treatment system to the drop chamber through an inlet hole in which the inlet hole is lower than the outlet hole of the trap chamber to facilitate treated storm water runoff to gravity drain from the drywell to the treatment system and back to the drywell;

a drain hole in the drop chamber that is located in the integral bottom; and

one or more perforated precast concrete cylinders situated below the integral bottom in which the storm water runoff is deposited through the drain hole of the drop chamber.

2. The drywell retrofit diverter top of claim **1** wherein the vertical dividing wall runs from the integral bottom to just below the level of the precast concrete cover to allow storm water runoff to spill into the drop chamber from the trap chamber and directly into the perforated precast concrete cylinders if the outlet hole is unable to direct storm water runoff to the treatment system.

3. The drywell retrofit diverter top of claim **1** wherein the integral bottom is sized and shaped to fit a cylindrical shaped perforated precast concrete cylinder of an already existing drywell.

4. The drywell retrofit diverter top of claim **3** in which the integral bottom is notched to align with the top of cylindrical shaped perforated precast concrete cylinder.

5. The drywell retrofit diverter top of claim **1** further comprising an access hole in the precast concrete cover situated above the drop chamber in which samples of storm water runoff can be drawn and tested.

6. The drywell retrofit diverter top of claim **1** wherein the materials used to make the various components of the drywell retrofit diverter top include; steel, plastic, concrete or a combination of these materials.

7. The method of retrofitting a drywell with a drywell diverter top, comprising

excavating around a preexisting drywell;

exposing a precast concrete cone of an already existing drywell;

removal of the precast concrete cone;

fabricating a precast concrete vessel having a bottom that integrates with a remaining drywell chamber, a trap chamber, a drop chamber with the two chambers being separated by a vertical dividing wall that sits upon the bottom, a precast concrete cover that integrates with the vessel and sits above the trap and drop chambers with a manhole and a grated top which directs storm water runoff to drain into the trap chamber, the trap chamber having an outlet hole situated above a floor of the trap chamber, the outlet hole directing the storm water runoff to a treatment system that is gravity fed through the outlet hole, a return line from the treatment system to the drop chamber through an inlet hole in which the inlet hole is lower than the outlet hole of the trap chamber to facilitate gravity drainage from the drywell to the treatment system and back to the drywell, a drain hole in the drop chamber that is located in the integral bottom;

placing the fabricated precast cast concrete vessel upon a precast perforated concrete cylinder within the drywell;

locating and placing a treatment system to allow for gravity feed of storm water runoff to drain from the trap chamber to the treatment system and back to the drop chamber;

excavating a line from the drywell to the treatment system;

inserting a pipe from the drywell diverter top outlet hole of the trap chamber to the treatment system;

inserting a pipe from the treatment system to the drop chamber inlet hole; and

backfilling around the drywell for proper runoff.

* * * * *