ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

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Implementation Guidelines for Drywells That Use Flow Control and / or Pretreatment Technologies Under the Aquifer Protection Program General Permit Types 2.01 and 2.04

This drywell guidance manual contains:

- **a summary of aquifer protection rules and other regulations that drywells may be subject to;**
- **clarifications of certain parts of both drywell general permit rules;**
- **an evaluation of certain stormwater pollution control devices**
- **general guidelines for design, installation, maintenance and inspection of all drywells.**

Implementation Guidelines for Drywells That Use Flow Control and/or Pretreatment Technologies Under the Aquifer Protection Program General Permit Types 2.01 and 2.04

INTRODUCTION

Purpose, Use and Organization of this Manual

This guidance manual is the product of several meetings held in 2001 and early 2002 with stakeholders who have drywells that are subject to the Arizona Department of Environmental Quality's (ADEQ) Aquifer Protection Program (APP), needing either a general APP permit or an individual permit. The purpose of the meetings was to gain consensus on a list of stormwater flow control and pretreatment technologies that ADEQ would approve for use with drywells that needed an APP permit.

ADEQ hired Brown and Caldwell to research and evaluate existing technologies that treat stormwater before it enters a drywell. The list that resulted became a pre-approved list of technologies incorporated into a second rule for drywells which ADEQ promulgated on September 15, 2002. This list is now published in this guidance manual for use when applying for authority to discharge under a Type 2.04 general permit (Drywells that Drain Areas at Motor Fuel Dispensing Facilities Where Motor Fuels Are Used, Stored, or Loaded (A.A.C. R18-9-C304)). Readers may find the guidance and the list of technologies in this manual useful when applying for an authorization to discharge under a Type 2.01 general APP permit (Drywells That Drain Areas Where Hazardous Substances Are Used, Stored, Loaded, or Treated (A.A.C. R18-9-C301).

This manual is intended primarily as guidance to support the Type 2.04 general APP permit, described in A.A.C. R18-9-C304, Drywells that Drain Areas at Motor Fuel Dispensing Facilities Where Motor Fuels Are Used, Stored, or Loaded. However, much of the information contained herein is also applicable to the Type 2.01 permit for drywells that drain areas where hazardous substances are used, stored, loaded, or treated (A.A.C. R18-9-C301). This manual provides a synopsis of the various flow control and pretreatment devices that are suitable in preventing discharges of polluted stormwater to the aquifer and is subdivided into four sections:

- a summary of APP rules and other regulations that drywells may be subject to;
- clarifications of certain parts of both drywell general permit rules;
- an evaluation of pollution control technologies that are ADEQ–approved for use in a drywell that may discharge under a Type 2.04 general permit; a summary table of local jurisdictions' codes about stormwater retention are included at the end of this section; and
- general guidelines for design, installation, maintenance and inspection of all drywells.

SUMMARY OF AQUIFER PROTECTION RULES APPLICABLE TO DRYWELLS

The Purpose for Drywells

A drywell is a bored, drilled, or driven shaft or hole with a depth that is greater than its width and that is designed and constructed specifically for the disposal of stormwater (Arizona Revised Statutes (A.R.S.) § 49-331(3)). Stormwater flows over many surfaces that may hold other pollutants. Drywells that receive stormwater with pollutants can potentially render the aquifer useless as a drinking water source. Arizona's aquifer protection program is designed to protect groundwater for drinking use and federal primary drinking water maximum contaminant levels are adopted as numeric aquifer water quality standards (AWQS). An APP permit is needed if you own or operate a facility that discharges either directly to an aquifer or to the land surface or the vadose zone in such a manner that there is a reasonable probability that the pollutant will reach an aquifer.

Disposal of other wastewaters into a drywell, either solely or in conjunction with stormwater, is prohibited. If a drywell is used to dispose of anything other than stormwater, the well is classified as an injection well, and an individual APP is required for operation or closure. Furthermore, a drywell that receives discharges other than stormwater will be subject to federal underground injection control regulations. Two stage drywells are not designed for the continual discharge of water, but for sporadic discharges resulting from heavy precipitation events. Injection wells must be constructed to manage the continual discharge of water most efficiently.

Drywell Registration

Any person who owns a new or existing drywell is required to properly register it using myDEQ, ADEQ's online portal. Visit azdeq.gov/drywell_registration for more information. The registration fee is $100 per drywell, and is valid for the life of the drywell. A physical change or addition to the drywell design will require completion of a new registration and a $100 fee to ADEQ. A transfer of drywell ownership requires notification to ADEQ through myDEQ and a $50 fee.

Registration helps ADEQ maintain a statewide database / inventory of drywells. As part of the registration process, owners of registered drywells are notified of aquifer protection permitting requirements.

Any drywell constructed for the purpose of golf course maintenance is exempt from the registration requirements unless it receives stormwater mixed with reclaimed wastewater or groundwater or both, from manmade bodies of water associated with golf courses, parks and residential common areas.

General Permits for Drywells

General aquifer protection permits have technical standards and permit conditions stipulated in rule. A general permit is designed to expedite the permit process at a lower cost to the applicant for classes of discharging facilities that are substantially similar in nature. These permits are

simpler and take fewer hours to process than an individual permit. These general permits rely on clear technical standards to ensure that a discharging facility does not violate aquifer water quality standards and that the facility employs the best available demonstrated control technology (BADCT) or best management practices in its design, construction, operation and maintenance.

An APP is required whenever a drywell is installed in areas where toxic or hazardous materials, including motor fuels, are used, handled, stored, loaded or treated, or where a spill of such materials could drain into the drywell system. Design and operational restrictions may apply to a drywell that is located in such areas. These drywells require either one of two general APP permits (Type 2.01 or 2.04) or an individual APP permit to ensure that the drywell and any aquifer beneath it is protected. Such areas may include loading docks, fuel pumps, waste and product storage areas, etc. ADEQ recommends against installation of drywells in such areas. However, if installation is necessary, then a permit is required.

The drywell may be eligible for a general APP, if an engineered design which utilizes interceptors, sumps or other devices to remove, intercept and collect pollutants is installed as BADCT. If a drywell is used for any other discharges, it is classified as an injection well, and an individual APP is required for operation or closure. This type of operation may also trigger regulation under the federal Underground Injection Control program.

A Type 2.01 General Permit is available for drywells that drain areas where hazardous substances are used, stored, loaded or treated. Such drywells are common for stormwater disposal at facilities with potential for spills of pollutants into those drywells. A Type 2.04 General Permit is available for drywells that drain areas at motor fuel dispensing facilities where motor fuels are used, stored, or loaded.

The Type 2.04 general permit was written for fuel dispensing facilities (including commercial gasoline stations with an underground storage tank) where motor fuels are the only hazardous substances used, stored, or loaded within the drainage area of the drywell. The purpose of both general permits is to ensure that: (1) drywells do not receive discharges other than stormwater, (2) the aquifer is protected from pollutants that may be discharged into it, and (3) to expedite the permitting process for qualifying facilities.

To obtain a drywell general permit, you must file a notice of intent (NOI) to discharge and a supplemental form with ADEQ before a discharge is allowed. The department will send the permittee an acknowledgment of the notice with a facility registration number. The permittee need only agree to comply with the terms of the general permit (either Type 2.01 or 2.04) including any applicable design, operational, record keeping and reporting requirements specified in rule. Drywell general permits must be renewed by the permittee every five years.

The two general permits only allow for disposal of stormwater. BADCT for Type 2.01 and 2.04 general permits restrict a drywell’s location and requires that it’s design include a flow control and/or pretreatment device. Existing drywells require certification that past discharges have not impacted groundwater quality. The permittee is responsible for control of detrimental practices, recordkeeping, reporting of spills, maintenance, inspections, employee training, sampling.

Submittal of a Best Management Practices Plan (BMPP) is required for a 2.01 general permit, whereas prescriptive BMPPs are contained in the 2.04 permit. Applicants have more latitude in design, maintenance, operations and BMPPs in the 2.01 permit.

In conclusion, drywells that drain areas where hazardous substances, including motor fuels, are used, stored, loaded or treated are required to obtain either an individual or a general aquifer protection permit (APP). The general permit that applies is dependent on the substances and their potential to reach the drywell and whether a flow control device is required. The Type 2.04 general permit for motor fuel dispensing facilities requires the design to include a flow control or pretreatment device (A.A.C. R18-9-C304(C)(1)(a)); however, the Type 2.01 general permit only requires a method to remove, intercept or collect pollutants that have the potential to reach the drywell (A.A.C. R19-9-C301(C)(4)) that may include a flow control or pretreatment device. A flow control device may be a normally closed manual or automatic valve, a raised drywell inlet, or a magnetic mat or cap, in combination with the use of best management practices to prevent spills from reaching the drywell. Regardless of the permitting status, all drywells must be registered.

The reader can find regulations governing drywell operation, etc. in A.R.S. § 49-245.02 (general permit for certain discharges associated with man-made bodies of water), 49-331 through 49-336 (laws regulating drywells); A.R.S. § 49-250(23) (APP discharge exemptions); A.R.S. § 49-201(5) (clean closure definition); and A.R.S. § 49-241 (permit required to discharge). The reader is also urged to consult the general provisions in the rules that apply to all general permits (Arizona Administrative Code (A.A.C.), Article 3, Part A) and the rules governing the drywell general permits in A.A.C. R18-9-C301 and R18-9-C304.

A Word About Exemptions from the Aquifer Protection Program

A site could be designed to be exempt from the aquifer protection program by modifying it to prevent drainage, spills of motor fuel and other hazardous substances from leaving the drainage area and entering the drywell. This modification can be accomplished in a number of ways, such as installing concrete curbs or altering the surface grading patterns of the site so that drainage from affected areas cannot reach the drywell. A site plan should show surface grading details designed to prevent drainage and spills from leaving the drainage area and entering the drywell. The site plan should include the location of floor drains, water supply, monitor wells, underground storage tanks, chemical and waste usage, storage, loading, and treatment areas and places where motor fuels and other hazardous substances are used, stored or loaded.

Drywell Closure

Clean closure in the aquifer protection program is available to drywells that can be demonstrated that there will be no further discharge and that Aquifer Water Quality Standards will continue to be met at the point of compliance. Clean closure means no post-closure monitoring and maintenance are necessary. To protect groundwater, closure of a drywell should conform with ADEQ's Drywell Decommissioning Guidelines or provide equivalent protection. Drywells must be registered prior to closure and a closure APP may be required. APP fees will apply if an individual APP, Type 2.01 or 2.04 general APP or clean closure is needed.

If your drywell was properly registered, was exempt from the APP program and received only stormwater, you need only follow ADEQ's Drywell Decommissioning Guidelines. However, you must notify ADEQ of your intent to permanently close a drywell that has an APP or was not registered with ADEQ. A Clean Closure Application can be used for this purpose. The information required in the application includes a description of the discharge history, a sampling plan for the past discharges, discharge locations, maps and facility design plans, wastestream characterization, a description of the treatment processes used, discharge flow rates, and a point of compliance.

ADEQ will not declare any clean closure application administratively complete until you submit the results of your sampling plan. We strongly recommend you seek ADEQ approval prior to initiating the plan to minimize the need for additional sampling.

Clarifying Guidance for Certain Parts of the Drywell Rules

Recordkeeping requirements specified in A.A.C.R18-9-A301(E) and R18-9-C304(I): ADEQ considers electronic record keeping (i.e., records kept in electronic format in a computer) to satisfy the requirements of these two subsections. Permittees may keep the required records at a central location that is separate to the facility in circumstances where the drywell is located at a facility that is unmanned, such as an unmanned fuel dispensing facility or a drywell located at a remote location that is not normally permanently staffed on site.

The recordkeeping period is a "rolling" ten year period. In other words, the ten year recordkeeping requirement is interpreted to include the ten years immediately preceding the most recent inspection, maintenance or other recordkeeping entry and includes any period(s) of previous ownership.

Spills described in A.A.C.R18-9-A301(F) and R18-9-C304(H): A prescribed maximum spill quantity was deliberately omitted from both rules. Instead, to accommodate the need for flexibility in site–specific design, individual permit applicants should decide what size spill they want to handle and install the appropriate technology. ADEQ decided to leave any sizing requirements for retention basins to the cities and counties, if they have any. Any requirement ADEQ might have prescribed in rule or proposed in guidance would conflict with existing municipality requirements (see Table A).

If ADEQ had prescribed a minimum retention capacity in rule or guidance, the retention capacity of any reservoir that holds a spill would have to be significantly greater than the anticipated spill (for example, a 500 or 1000 gallon spill). This would be very problematic for small sites. When stormwater runoff accumulated just before, during or after a spill event (i.e., before the spill could be removed), the basin would have to be sized to accommodate the spill plus the runoff so that both could be stored safely until the water was treated and discharged into the drywell.

FLOW CONTROL AND PRE-TREATMENT TECHNOLOGIES FOR DRYWELLS

Introduction

This section is an objective evaluation of nine general categories of bona-fide stormwater flow control and pretreatment technologies that will satisfy the requirements of either a Type 2.01 or 2.04 drywell general permit. These existing technologies were researched, evaluated and grouped based on their merits to remove gasoline components, as well as their usefulness in overall stormwater flow control and pretreatment.

The intent of both drywell general permits is to expedite the permitting process for qualifying facilities. A stormwater discharge to a drywell at a motor fuel dispensing facility authorized by a Type 2.04 general permit must utilize one or more of the flow control and/or pretreatment devices discussed in the following pages. Remember, however, that no drywell is allowed to receive any discharges other than stormwater.

Type 2.01 general permits have more latitude as to the type of flow control and/or pretreatment devices that can be used, and, depending on site and pollutant characteristics, some technologies must be used in combination with one or more other technologies that will protect the aquifer from pollutants that may be discharged into a drywell. In other words, a certain technology which may be suitable for one facility at a certain location may be unsuitable at the same type of facility in a completely different location with different drainage patterns and spill potential. Finally, please note that two technologies that were evaluated found to be unacceptable as pollution control devices and are not discussed in this section on flow control and pre-treatment technologies.

- Discriminating Float Assemblies

    - Description – Any form of normally open valve with a sensor that closes the valve if no fluid is present or when a non-conductive liquid is detected. The valve is typically electronically actuated by the sensor assembly, but may be set for manual operation. This technology must be coupled with a retention basin or other storage technology. Based on the information reviewed, this technology does not appear to offer enough safeguards to prevent releases from discharging into a drywell.

- Submerged Flow Vegetative Treatment Systems

    - Description – A treatment technology utilizing an engineered aquatic plant and naturally occurring microorganism system to uptake and biodegrade petroleum hydrocarbons and other pollutants in run-off. The system must be installed inside a retention basin to allow sufficient retention time for the system to function properly. The system may require additional irrigation to keep the system viable.

    - Based on the information reviewed, this technology does not appear to offer enough safeguards to prevent releases from discharging into a drywell.

Information reviewed indicated that these systems were capable of approximately 55 to 95 percent removal of hydrocarbons passing through the system. The combination of plant species and microorganisms have the potential to uptake and biodegrade a number of organic and inorganic pollutants, but must be specifically engineered to the site's requirements. Because these systems must be specifically engineered for each site and its pollutants, ADEQ must review the engineering design. As such, an individual APP permit application will be required.

General Limitations

- Operation and Maintenance (O & M) costs for most technologies discussed below may include pumping and treatment of hazardous substances.

- All technologies discussed in this document must conform to the local jurisdiction regulating retention time and storage capacity of the stormwater. Consult Table A at the end of this section for stormwater retention requirements in various localities.

- The definition of "pollutants" used in this document does not excuse a permittee from knowingly or unknowingly discharging other pollutants into the aquifer.

Flow Control Technologies

1. Normally Closed Valves, Manual or Automatic

- Description – Any form of normally closed valve that shuts off flow to the drywell. After rainfall/storm events, the valve is temporarily opened to allow flow into the drywell. The valve can be manually or electronically actuated, or may include a sensor that actuates the valve upon detecting hazardous materials. This technology must be coupled with a retention basin or other storage technology.

- Capital Costs – Installation costs are dependent on the design of the collection system and drywell. Typical capital costs for purchase and installation of 4- to 8-inch manually actuated valves are low to medium. Electronic and sensor-actuated valve costs are typically high. Expensive modifications to the drywell and retention basin may be required in order to install the valve.

  - O & M Considerations – Operation and maintenance of this technology include periodic inspection and maintenance of valves and associated piping, and actuating/closing the valve when draining the basin. Additional O & M costs may include pumping and disposal if pollutants are present in the retention basin.

- Spatial Considerations – Minimal; this technology consists of a valve on the drywell inlet. However, this technology also requires a retention basin.

- Pollutant Treatment – Not applicable. This technology does not provide pre-treatment. In the event of a release, pollutants will be prevented from discharging to the drywell and will accumulate in the retention basin. Storage volume of the retention basin will be

dependent on design considerations and local codes and regulations. The storage volume of the retention basin determines the quantity of pollutants or stormwater that are retained.

- Applicable Pollutants – Dependant on valve construction and material. Can be designed to function in almost any environment and be compatible with almost any pollutant. The burden is on the permittee to ensure that discharge to the aquifer does not contain concentrations above regulatory limits of hazardous substances deriving from industrial activities at the site. Pollutants must be removed from the retention basin and other storage areas before discharging stormwater to the aquifer.

  - Light Non-Aqueous Phase Liquids (LNAPL) – Effective

  - Dense Non-Aqueous Phase Liquids (DNAPL) – Effective

  - Dissolved Pollutants – Effective

  - Solids – Effective

- Limitations

  - Valves are a flow control technology and do not provide any pretreatment. Valves must be used in conjunction with a retention basin or other method of stormwater capture and storage to be effective.

  - Operator training is required for O & M, inspection, and actuating/closing the valves when draining the basin.

  - Valve material must be selected based on potential pollutants. Valve components may rust or degrade, depending on material, if exposed to water or certain pollutants. Additionally, solids can cause the valve to bind or seize.

  - Sensor actuated valves must be specific to the type of pollutants present at the facility.

  - Valve must be left in closed position except to drain. In the event there is a release of a pollutant and the valve leaks or the valve was left in the open position, the pollutant will be able to enter the drywell.

  - The facility must conform to local codes and regulations regarding retention period for standing water and design of drywell and collection system.

  - The burden is on the site operators to ensure that any stormwater that is allowed to discharge into the drywell upon opening of the valve does not contain pollutants, in conformance with the general permit requirements. Therefore, pollutants must be removed from retention basin and other stormwater storage areas before the non-contaminated stormwater is allowed to drain into drywell.

- Potential for accidental discharge to drywell is high if valve is left open or leaks.

- The potential exists for the storage capacity of the retention basin to be exceeded with the valve in the closed position, allowing uncontrolled flow of stormwater or pollutants off site.

- System must be designed such that the operator does not need to enter standing water to activate the valve.

- This technology is only applicable at sites where there is minimal risk of contamination resulting from a spill or release reaching the drywell inlet.

- Use of this technology is subject to approval by the ADEQ permit case manager.

2. Raised Drywell Inlet Within Retention Basin

- Description – Raises the intake elevation of the drywell, within a retention basin. The inlet is raised above bottom of retention basin to provide a non-draining storage capacity within the retention basin.

- The inlet height must be raised a minimum of 6 inches above the bottom of the retention basin, and provide a storage capacity equal to the combined volume of the design storm event required by the local jurisdiction and 110% of the maximum releasable quantity of pollutant, as determined by the applicant. Additional technologies, such as a hydrocarbon sensor and valve assembly may be coupled with the raised drywell inlet for additional security. The valve/sensor system consists of a valve with a sensor that closes the valve if no fluid is present or when a nonconductive liquid is detected.

- Capital Costs – Capital costs for raising a pre-existing drywell inlet are low to medium, but are dependent on the design of the collection system and drywell. Capital costs for installation of sensor-actuated valves are high. For existing sites with large maximum releasable quantities of pollutants, significant modifications to the retention basins may be required. O & M Considerations – O & M includes periodic inspection of drywell and basin, and pumping if pollutants are present.

- Spatial Considerations – Not applicable; this technology is completely dependent on size of retention basin.

- Pollutant Treatment – Not applicable. This is a flow control method only, and provides no treatment. This technology increases storage capacity by providing a non-draining volume between the bottom of the retention basin and the top of the drywell inlet. The volume of stored water is dependent on the geometry/size of the storage basin and elevation of drywell inlet.

- Applicable Pollutants – Dependent on volume released; this technology is applicable to all pollutants as long as the storage capacity of the basin is not exceeded. This technology does not provide any treatment. Once storage capacity is exceeded, this technology

allows direct discharge of pollutants to the drywell. - Light Non-Aqueous Phase Liquids (LNAPL) – Effective, if pollutants are pumped from retention basin before discharging to drywell. However, floating pollutants will reach the drywell inlet first. The presence of a hydrocarbon sensor-actuated valve increases the potential for sealing the drywell inlet during a release.

- Dense Non-Aqueous Phase Liquids (DNAPL) – Effective, if pollutants are pumped from retention basin before discharging to drywell.

- Dissolved Pollutants – Effective, if pollutants are pumped from retention basin before discharging to drywell.

- Solids – May be effective, if pollutants are pumped from retention basin before discharging to drywell.

- Limitations
  - Raising the drywell inlet is a flow control technology and does not provide any pretreatment. This technology must be used in conjunction with a retention basin or other method of stormwater capture and storage to be effective.

  - Leaves volume of water/pollutant in retention basin that does not drain into the drywell. The design standing water retention period needs to be within the local jurisdiction's allowable time period for discharge of stormwater from the retention basin.

  - May require pumping after release or storm event, and prior to water level reaching top of drywell inlet. May require continuous supervision or inspection of depth of water in retention basin during extended storm events to ensure that water level does not reach top of raised inlet.

  - If the design retention period exceeds the local jurisdiction's allowable time period for discharge of stormwater from the retention basin, the non-draining volume of water must be pumped from the retention basin. If the stormwater does not contain any pollutants, the water may be discharged to the drywell. To discharge the water to the drywell, a sump and pump must be installed in the retention basin. Use of this pump must be carefully monitored to ensure that no pollutants are pumped to the drywell.

  - Requires periodic sediment removal to maintain the required drywell inlet height above the bottom of the retention basin.

  - For sites where free product or LNAPL may potentially be released into the retention basin, the capacity of the basin must be carefully considered because the free product or LNAPL will preferentially flow into the drywell when the liquid level in the retention basin reaches the drywell inlet. For sites with the potential for

free product or LNAPL releases, permittees should consider combining the raised inlet with another flow control or pretreatment technology.

- Operator training is required for O & M and inspection of drywell inlet and retention basin.

- Potential for accidental discharge to drywell is high if storage capacity of retention basin is exceeded during a release or storm event.

- The burden is on the Site operators to ensure that any liquid that is allowed to flow into the drywell does not contain pollutants.

- Requires applicant to calculate the volume of run-off generated in the design storm event, and anticipate the maximum potential pollutant release quantity.

3. Magnetic Mat or Cap

- Description – Any form of magnetic mat or cap that seals off the drywell inlet. The mat or cap is left on the drywell inlet under normal conditions. After rainfall/storm events the mat or cap is temporarily removed to allow flow into the drywell. This technology must be coupled with a retention basin or other storage technology.

- Capital Costs – Capital costs are low

- O & M Considerations – Operation and maintenance of this technology include periodic inspection and maintenance of the magnetic caps or mats, and removing/replacing the device when draining the basin. Additional O & M costs may include pumping if pollutants are present in the retention basin.

- Spatial Considerations – Minimal; this technology consists of a cap or mat on the drywell inlet. However, this technology also requires a retention basin.

- Pollutant Treatment – Not applicable. This technology does not provide pre-treatment. In the event of a release, pollutants will be prevented from discharging to the drywell and will accumulate in the retention basin. Storage volume of the retention basin will be dependent on design considerations and local codes and regulations.

- Applicable Pollutants – This is a flow control technology and does not provide any treatment. The burden is on the site operator/permittee to ensure that discharge to the aquifer does not contain concentrations above regulatory limits of hazardous substances derived from industrial activities at the site. Pollutants must be removed from the retention basin and other storage areas before discharging stormwater to the aquifer.

    - Light Non-Aqueous Phase Liquids (LNAPL) – Effective

    - Dense Non-Aqueous Phase Liquids (DNAPL) – Effective

- Dissolved Pollutants – Effective

- Solids – Effective

- Limitations

  - Magnetic mats/caps are a flow control technology and do not provide any pretreatment. Mats/caps must be used in conjunction with a retention basin or other method of stormwater capture and storage to be effective.

  - Operator training is required for O & M, inspection, and removal/replacing the mats/caps when draining the basin.

  - Magnets may not be suitable for many potential pollutants. Mats or caps and associated parts may rust or degrade, depending on material, if exposed to water or certain pollutants. Additionally, solids can cause leakage between the mat and the drywell inlet.

  - This system must be designed with safety of the operator in mind. Issues of concern include designing the system so that the operator does not need to enter standing water to remove/replace the mat, and ensure that upon removing the mat the operator is not pulled into the drywell by the force of the draining water.

  - Magnetic mat/cap must remain in the closed/sealed position on the drywell inlet, except when draining non-contaminated water from the retention basin. In the event there is a release of a pollutant and the mat/cap leaks or was left off of the inlet, the pollutant will be able to enter the drywell.

  - The facility must conform to local codes and regulations regarding retention period of standing water and design of drywell and collection system.

  - The burden is on the site operator to ensure that any stormwater that is discharged into the drywell when the valve is opened does not contain pollutants, in conformance with the general permit requirements. Therefore, pollutants must be removed from retention basins and other stormwater storage areas before the non-contaminated stormwater is allowed to drain into the drywell. The site operator must ensure that the mat or cap remains on the drywell inlet at all times, unless draining non-contaminated stormwater to the drywell.

  - Potential for accidental discharge to drywell is high if the mat/cap leaks or is left off.

  - The potential exists for the storage capacity of the retention basin to be exceeded with the mat/cap installed on the inlet, allowing uncontrolled flow of stormwater or pollutants off site.

- This technology is only applicable at sites where there is minimal risk of contamination resulting from a spill or release reaching the drywell inlet.

4. Primary Sump, Interceptor, or Settling Chamber

- Description – This technology includes installation of a chamber or sump for stormwater to flow into prior to entering the drywell. The sump allows for settling of suspended solids. The drywell inlet can be inside the sump or in a separate chamber. The sump may be connected by piping and valving to the drywell, or may require pumping to discharge liquids to the drywell.

- Capital Costs – Capital costs are medium to high, depending on site considerations and design requirements.

- O & M Considerations – Includes periodic inspections and maintenance of the equipment. Additional O & M costs may include pumping if pollutants are present in the sump.

- Spatial Considerations – This technology requires a relatively small area for installation. For a typical ¼- to 1-acre site, the equipment requires an approximately 6 to 10 foot diameter by 10 to 25 feet deep excavation or boring. This does not include installation of the drywell itself.

- Pollutant Treatment – Not applicable. This technology does not provide pre-treatment. In the event of a release, pollutants may be prevented from discharging to the drywell by accumulation in the sump. Storage volume of the sump will be dependent on design considerations and local codes and regulations. The storage volume of the sump determines the quantity of pollutants or stormwater that are retained. Typical sizes for a ¼- to 1-acre site are 1,000 to 1,500 gallons in the sump/primary collector, but are dependent on site conditions and quantity of pollutants stored. Storage capacity of pollutants from a release during a dry period is greater than storage capacity during a storm event.

- Applicable Pollutants – This technology does not provide any treatment. This technology only provides a storage volume prior to discharge into the drywell inlet. If the sump is directly connected to the drywell, pollutants may be discharged if the liquid level reaches the drywell inlet. If the sump is separate from the drywell, pollutants will enter the drywell only if pumped.

    - Light Non-Aqueous Phase Liquids (LNAPL) – Limited effectiveness, depending on design of sump and drywell.

    - Dense Non-Aqueous Phase Liquids (DNAPL) – Limited effectiveness, depending on design of sump and drywell.

- Dissolved Pollutants – Limited effectiveness, depending on design of sump and drywell.

- Solids – Effective. If flow into primary sump/settling chamber is below design capacity, solids will settle out until capacity of sump/settling chamber is exceeded.

- Limitations

  - This technology does not provide for any pretreatment of liquid or solid phase pollutants. This technology does allow storage of pollutants until the capacity of the sump is exceeded.

  - Operator training is required for operation, maintenance, and inspections.

  - Improper operation and maintenance can result in pollutants being allowed to flow into the drywell with no pre-treatment.

  - Improper design of sump and connection to drywell can result in pollutants being allowed to flow into the drywell with no pre-treatment.

  - Burden is on applicant to show that the maximum potential pollutant release quantity will be retained in the sump without discharge to the drywell.

  - The burden is on the site operators to ensure that any stormwater that is discharged into the drywell from the sum does not contain pollutants, in conformance with the General Permit requirements. Therefore, pollutants must be removed from sump before non-contaminated water is allowed to drain into the drywell.

  - Potential for accidental discharge to drywell or uncontrolled flow of pollutants off site is high if storage capacity of sump is exceeded during a release or storm event.

  - If the sump discharges to the drywell by a pump, use of the pump must be carefully monitored to ensure that no pollutants are pumped to the drywell.

  - If sump discharges to the drywell through a normally closed valve or magnetic mat/cap, all limitations of those technologies are also applicable.

Pre-treatment Technologies

1. Combined Settling Chamber and Oil/Water Separator

   - Description – A system incorporating a catch basin inlet, settling chamber/collector, and oil/water separator. May also incorporate a self-sealing mechanism or process, preventing bypass of pollutants to drywell during high flow.

   - Capital Costs – Capital costs are high

   - O& M Considerations – Includes periodic inspections and maintenance of the equipment and removal of collected pollutants from the oil/water separator.

   - Spatial Considerations – This technology requires a relatively large area for installation. For a typical ¼-acre site, the equipment requires an approximately 10-foot by 20-foot wide by 10-foot deep excavation.

   - Pollutant Treatment – Dependent on the design and requirements at the facility, but typical sizes for a ¼- to 1-acre site are 1,000 to 1,500 gallons in the primary collector, which may also act as an oil/water separator, and 1,500 gallons in the interceptor. The systems can be designed larger or smaller based on site requirements. Storage capacity of pollutants from a release during a dry period is greater than storage capacity during a storm event. Higher outflow rates could require considerably larger collection and treatment vessels to allow proper retention time for solid/liquid separation.

   - Applicable Pollutants

     - Light Non-Aqueous Phase Liquids (LNAPL) – Effective, if the quantity of hydrocarbons do not exceed the capacity of the oil/water separator.

     - Dense Non-Aqueous Phase Liquids (DNAPL) – Effective. Depending on the design of the system, DNAPL constituents may be retained in the primary sump/settling chamber and oil/water separator.

     - Dissolved Pollutants – Not effective, unless system is coupled with another technology, such as sorbent materials.

     - Solids – Effective. If flow into primary sump/settling chamber is below design capacity, solids will settle out until capacity of sump/settling chamber is exceeded.

   - Limitations

     - Depending on the design of the system, this technology may leave a volume of water or pollutants in the system that does not drain.

- Certain models are designed to bypass pre-treatment during times of high flow. Thus, a large quantity spill, or a spill during a high rainfall event may bypass the system and be directly released to the drywell.

- Operator training is required for operation, maintenance, and inspections.

- Improper operation and maintenance can result in pollutants being allowed to flow into the drywell with little or no pre-treatment.

- If the technology utilizes a self-sealing mechanism that activates due to the presence of pollutants, uncontrolled flow of stormwater and pollutants across the surface of the site or off-site may occur. Additionally, the potential exists for the retained water not to be drained within the jurisdiction's required time period.

2. Combined Settling Chamber, Oil/Water Separator, and Filtration/Adsorbtion

   - Description – A system incorporating a catch basin inlet, settling chamber/collector, oil/water separator, and filtration or adsorbtion mechanism. May also incorporate a self-sealing mechanism or process, preventing bypass of pollutants to drywell during high flow.

   - Capital Costs – Capital costs are high.

   - O& M Considerations – Includes periodic inspections and maintenance of the equipment, pumping of pollutants from the oil/water separator, and replacement of the filtration or adsorption/absorption materials.

   - Spatial Considerations – This technology requires a relatively large area for installation. For a typical ¼-acre site, the equipment requires a 40-foot by 10-foot wide by 10-foot deep excavation.

   - Pollutant Treatment – Dependent on the design and requirements at the facility, but typical sizes for a ¼-acre site are 1,000 to 1,500 gallons in the primary collector, which may also act as an oil/water separator, and 1,500 gallons in the interceptor and filtration vessels. The systems can be designed larger or smaller based on site requirements. Storage capacity of pollutants from a release during a dry period is greater than storage capacity during a storm event. Depending on the technology, the filtration vessel may consist of a series of floating sorbent pillows, filter cartridges, or other devices allowing stormwater to pass through a sorbent material. Pollutant processing capacity will be dependent on the type and quantity of filter material and design of system. Dependent on size of facility, minimum design is for a treated outflow from the system to the drywell inlet of 20 gallons per minute (gpm). Flowrate can be designed higher or lower based on site requirements. Higher outflow rates could require considerably larger collection and treatment vessels to allow proper retention time for treatment.

- Applicable Pollutants
  - Light Non-Aqueous Phase Liquids (LNAPL) – Effective, if quantity of hydrocarbons do not exceed the capacity of the oil/water separator. LNAPL may be removed from the water by the sorbent/filter material, depending on the media selected. Depending on the shut-off mechanism utilized, the system may shut flow off to the drywell if capacity of the device is exceeded.

  - Dense Non-Aqueous Phase Liquids (DNAPL) – Effective. Depending on the design of the system, DNAPL constituents may be retained in the primary sump/settling chamber and oil/water separator. DNAPL may be removed from the water by the sorbent/filter material, depending on the media selected. Depending on the shut-off mechanism utilized, the system may shut flow off to the drywell if capacity of the device is exceeded.

  - Dissolved Pollutants – Somewhat effective, depending on the sorbent/filter material selected.

  - Solids – Effective. If flow into primary sump/settling chamber is below design capacity, solids will settle out until capacity of sump/settling chamber is exceeded.

- Limitations
  - This technology generally requires more space than other technologies, and may be expensive compared to other methods, particularly if a retention basin is required in conjunction with it.

  - Operator training is required for operation, maintenance, and inspections.

  - Improper operation and maintenance can result in pollutants being allowed to flow into the drywell with little or no pre-treatment.

  - If the technology utilizes a self-sealing mechanism that activates due to the presence of pollutants, flow into the drywell will stop but the flow of stormwater and pollutants across the surface of the site may be uncontrolled. Additionally, the potential exists for the retained water not to be drained within the jurisdiction's required time period.

3. Passive Skimmers

- Description – Consists of hydrocarbon sorbent materials (pads, socks, etc.) installed or suspended on top of the static water level in a sump or other catchment. The skimmers must be periodically replaced as pollutants are absorbed/adsorbed. This technology must be utilized in a system with some storage capacity.

- Capital Costs – Typical capital costs for purchase and installation of sorbent socks are low.

- O & M Considerations – Operation and maintenance of this technology include periodic inspection, maintenance, and replacement of the sorbent skimmers and mounting devices.

- Spatial Considerations – Minimal; this technology consists of one or more adsorbent skimmers suspended on the water level in a sump or catchment.

- Pollutant Treatment – Depending on the brand and configuration chosen, skimmers can absorb/adsorb 2 to 20 times their weight of hydrocarbons.

- Applicable Pollutants

  - Light Non-Aqueous Phase Liquids (LNAPL) – Effective, if the quantity of the LNAPL does not exceed the sorbent capacity of the skimmers.

  - Dense Non-Aqueous Phase Liquids (DNAPL) – Not effective

  - Dissolved Pollutants – Somewhat effective, if the quantity of the pollutants does not exceed the sorbent capacity of the skimmers, and the pollutants are capable of being sorbed by the skimmer material. Only the dissolved-phase pollutants that come into direct contact with the skimmer material will be treated.

  - Solids – Not effective

- Limitations

  - Skimmers must be used in conjunction with a retention basin or other type of storage to be effective.

  - Hydrocarbon sorbent skimmers are widely available, skimmers for other pollutants must be selected based on site and design requirements.

  - Operator training is required for O & M, inspection, and installing/replacing the skimmers. The spent skimmers must be removed and replaced.

  - Used skimmers must be disposed of in accordance with local, state and federal regulations.

  - Potential for accidental discharge to drywell is high if a release occurs when the skimmers are full. Additionally, the skimmers are designed to adsorb/absorb small quantities of pollutants. In the event of a large release, the quantity of the pollutant spilled may exceed the adsorption capacity of the skimmers. If large releases of pollutants are possible at a site, then passive skimmers must be coupled with some other technology, such as normally closed valves, to minimize untreated pollutant discharge into the drywell.

- Skimmers may be overwhelmed or bypassed by a release during a storm event, allowing pollutants into the drywell.

4. Catch Basin Inlet Filters

- Description – A pretreatment device designed to fit inside a pre-existing catchment drain. These products usually incorporate a basket containing a sediment/silt/trash catcher and hydrocarbon sorbent material. Some may contain other types of filter or sorbent materials. These are designed to prevent minimal quantities of solids and hydrocarbons from entering the drywell. Most catch basin inlet filters also have a high flow bypass.

- Capital Costs – Typical capital costs for purchase and installation of the catch basin inlets are low to moderate. Installation may require modification of the catchment inlet.

- O & M Considerations – Operation and maintenance of this technology include periodic inspection, maintenance, and replacement of the sorbent materials. Due to the limited treatment and storage capacity of the inlet filters, frequent O&M inspections may be required. Certain models are designed to be completely removed and replaced after coming into contact with pollutants.

- Spatial Considerations – Minimal; this technology typically consists of a basket suspended beneath a stormwater inlet or grate.

- Pollutant Treatment – Depending on the brand and configuration chosen, skimmers can absorb/adsorb 2 to 20 times their weight of hydrocarbons. The volume of solids retained in the filter is based on configuration, size, and design requirements.

- Applicable Pollutants – In all cases, the catch basin inlet filters are not effective if silted up or in periods where the flow exceeds the design capacity of the filter.

    - Light Non-Aqueous Phase Liquids (LNAPL) – Effective, if the quantity of the LNAPL does not exceed the sorbent capacity of the skimmer.

    - Dense Non-Aqueous Phase Liquids (DNAPL) – Not effective, unless the model selected has other filter or sorbent materials in the design.

    - Dissolved Pollutants – Not effective, unless the model selected has other filter or sorbent materials in the design.

    - Solids – Effective, if the quantity of solids does not exceed the storage capacity of the basket.

- Limitations

    - Hydrocarbon absorbent materials are widely available, filters for other pollutants may not be available.

- Limited treatment and storage capacity of catch basin inlet filters may require frequent O&M inspections and replacement.

- Operator training is required for O & M, inspection, and installing/replacing the catch basin inlet filters.

- Potential for accidental discharge to drywell is high if the catch basin inlet filters are full of solids, allowing flow to bypass the filter.

- The filters are designed to adsorb/absorb small quantities of pollutants. In the event of a large release, the quantity of the pollutant spilled may exceed the adsorption capacity of the filters.

- Filters may be overwhelmed or bypassed by a release during a storm event, allowing pollutants into the drywell.

- If large releases of pollutants are possible at a site, then catch basin inlet filters must be coupled with some other technology, such as normally closed valves, to minimize untreated pollutant discharge into the drywell.

TABLE A – STORMWATER RETENTION / DETENTION REQUIREMENTS OF LOCAL ARIZONA JURISDICTIONS

CITY	BASE STORM EVENT	MAX RETENTION TIME	DRYWELL DEPTH	MAX DRAINAGE VOL / DRYWELL	OTHER REQUIREMENTS
Apache Jct.	10–year 24 hour storm	36 hours	150 ft	no maximum drainage volume	none
Chandler	100–year, 2 hour storm	36 hours	10 feet into permeable layer	—	—
Gilbert	50–year, 24 hour storm	36 hours	10 feet into permeable layer	43,500ft^3	• Minimum settling basin depth of 19 feet • Standard: MaxWell IV or approved equivalent • see city codes for more
Glendale	100% detention / retention of a 100–year, 2-hour event	36 hours per Maricopa County Health Dept. (pest control reqm't)	10 feet into a permeable layer	Depends on DW capacity.	Contractor submit Drywell Notice to ADEQ with copy to the City
Mesa	50–year, 24 hour	36 hours	10 feet into permeable layer; depth <75 ft.	9300 ft^3	Separate silting chamber in retention areas with more than 3 drywells

CITY	BASE STORM EVENT	MAX RETENTION TIME	DRYWELL DEPTH	MAX DRAINAGE VOL / DRYWELL	OTHER REQUIREMENTS
Phoenix	100–year, 2–hour	36 hours	10 feet into a permeable layer	Not to exceed 0.1 cfs per well unless a greater rate can be supported by a detailed, certified soils report.	• Design must conform with ADEQ guidelines • The City inspector must be present before backfill or well pipes are placed within any drywell bore holes. • Operator responsible for cleaning and maintenance of each structure to assure proper working order. • Regular maintenance schedule shall not exceed 3 years.
Scottsdale	100–year, 2–hour	36 hours	––	—	• discharge – stored stormwater to the underground must be in accordance with the approved groundwater master plan and approved by the appropriate city officials. • must secure proper state and federal permits that allow stormwater discharge to the underground
Tempe	100–year, 1–hour	36 hours	––	—	—
Tucson		18 hours	10 feet into permeable layer	—	—

GENERAL GUIDELINES FOR ALL DRYWELLS

INSTALLATION REMINDERS

1. Drywells should be installed to dispose of only stormwater and urban surface run-off as defined in this guidance. Other discharges to a drywell may trigger requirements for regulation as an underground injection well under state and federal regulations.

2. No drywell should be installed closer than 100 feet from any water well. Drywells should be installed as far as possible, but no closer than 20 feet, from underground storage tanks, or fuel loading areas.

3. Installation of drywells where hazardous or toxic materials are used, handled, stored, loaded or treated, or where a spill of such materials could drain into the drywell system is not recommended. If it is necessary to install a drywell in such areas, an Aquifer Protection Permit will be required. If a permit is necessary, an engineered design that utilizes interceptors, sumps or other devices to remove, intercept and collect pollutants may be necessary to meet the required Best Available Demonstrated Control Technology (BADCT).

4. Drywell installers shall meet the licensing requirements of the State Registrar of Contractors and the Arizona Department of Water Resources (ADWR).

5. Drywells may not be installed to a depth that intersects the water table. The base of the drywell must be at least 10 feet above the top of the water table. In the event perched water tables are encountered, drywell systems may be constructed by an installer licensed by ADWR. The perching formation must be sealed per ADWR requirements.

6. If the above conditions can not be met, please consult with ADEQ.

DESIGN AND INSTALLATION

1. For drainage systems draining PAVED AREAS - a minimum of one standard drywell is recommended for each 6,000 cubic feet (cf). of drainage volume. *[Calculations are based on use of the Rational formula for a 10 year design storm with a 2 hour duration.]*

2. For drainage systems draining LANDSCAPED AREAS - a minimum of one standard drywell is recommended for each 15,000 cf of drainage volume.

3. The standard drywell system typically has a minimum effective settling capacity of 1,000 gallons per chamber. (Effective settling capacity = distance from bottom of settling chamber to the height of overflow outlet. For a 4 feet ID chamber this would be the equivalent of a chamber 16 feet deep inclusive of 5 feet of freeboard.)

4. Systems should use a shielding device to enhance separation of petrochemicals from water by gravity differentials. Such devices are to be vented to prevent siphoning or skimming of floating petrochemicals.

5. Systems should use a hydrophobic petrochemical absorbent with a minimum capacity of 128 ounces.

6. Systems should include a device to screen floating debris such as paper, leaves and other trash to retain such material within the settling chamber.

7. The system must be accessible from the surface for maintenance and inspection. Standard minimum opening is a 24-inch-diameter nominal size cast iron grating or manhole cover bolted in at least two locations. All inlets are to be marked in raised cast letters **"Stormwater ONLY"**.

8. Excavation and/or drilling is to be performed in a manner to maintain and protect the integrity of drainage soils.

9. A minimum penetration of 10 continuous feet into permeable porous soils is recommended for standard installations. In unstable sandy, gravely soils where "belling out" is a problem, an equivalent of 200 square feet (sf) of sidewall area is acceptable (bottom area is not to be included). If such penetration is not achieved or if the required design performance rate is greater than 0.25 cubic feet per second (cfs), a constant head percolation test should be performed on the completed system to determine performance.

10. Drywell inlets should be located at least 20 feet from retention basin surface inlets.

11. Multiple drywells should be spaced a minimum of 100 feet apart center to center.

12. Inlet connecting pipes to drywell systems should be a maximum of 6 inches in diameter.

13. Drywell surface grates should be raised a minimum of 3 inches above bottom of landscaped retention basins.

14. During construction, drywell inlets (including any remote inlets) should be sealed with two layers of U.V. protected geotextile fabric to prevent sediments from entering the drywells until paving and landscaping are complete.

DESIGN AND INSTALLATION IN HEAVY USE / INDUSTRIAL AREAS

1. A design that utilizes a pretreatment interceptor should be installed as a standard drywell system for the following drainage area applications:

    - When draining public right-of-ways or heavy use areas such as trucking facilities or maintenance areas.

- When draining areas impacted by industrial or manufacturing operations (except where hazardous chemicals are used, handled or stored).

- When more than one acre and up to a maximum of two acres of paved surface drains to a single drywell.

- When more than 2.5 acres and up to a maximum of 5 acres of landscaped surface drains to a single drywell.

2. The interceptor should be a sealed unit with an effective settling capacity of at least 500 gallons and a maximum outflow capacity of 0.25 cfs.

3. Systems should use shielding devices to enhance separation of petrochemicals from water by gravity differentials.

4. Systems should use hydrophobic petrochemical absorbents with a minimum capacity of at least 256 ounces per chamber.

5. A device to screen floating debris such as paper, leaves and other trash should be used to retain such material within the settling chambers.

6. The system must be accessible from the surface for maintenance and inspection. Standard minimum opening is a 24 inch diameter nominal size cast iron grating or manhole cover bolted in at least two locations. All inlets are to be marked in raised cast letters **"Stormwater ONLY"**.

INSPECTION

1. Inspection should be performed at least annually or if water remains standing on the surface of the drainage area or retention basin for longer than 36 hours.

2. Activities performed within the drainage area should be reviewed to ensure that chemicals are not used, handled or stored within that area, unless authorized by an aquifer protection permit. Visual observations should be made for non-stormwater discharges such as unusual stain or pavement discoloration surrounding the drywell, residue coating the inlet grate or within drywell sediments, or the presence of unusual odors in the settling chamber.

3. Settling chambers and interceptor compartments should be visually inspected for type and quantity of debris and condition of drainage components. Remove debris and sediment as required under "Maintenance".

4. If chemical absorbents are discolored and/or submerged beneath the water surface, they should be replaced.

5. ADEQ recommends a copy of all inspections and a record of findings and maintenance activities be kept on file at the property where the drywell is located. An inspection checklist that may be helpful when performing annual inspections is available from ADEQ.

6. During construction, drywell inlets (including any remote inlets or connected catch basins) should be sealed with two layers of U.V. protected geotextile fabric to prevent sediments from entering the drywells until paving and landscaping are complete.

7. A solid manhole cover should be installed on the drywell to insure flow is through the interceptor inlet only. The cover should be bolted in at least two locations and marked in raised cast letters **"Stormwater ONLY"**.

8. Best Management Practices (BMPPs) should be followed for drywells located in industrial areas. A separate BMPP Guidance document is available from ADEQ.

MAINTENANCE

1. The drainage system including settling chambers and interceptors should be inspected annually.

2. Removal of deposited silt and sediment may be performed with the annual inspection, or at a minimum as follows:

   - In paved areas - when the sediment level fills 10% of the effective settling capacity.

   - In landscaped areas - when the sediment level fills 25% of the effective settling capacity.

   - When ownership of the property changes.

   - When material not resulting from stormwater or urban surface runoff enters the drainage system interceptor or drywell settling chamber.

3. Maintenance should include removal of all sediment, cleaning of all filters and screens and replacement of chemical absorbents. Removed material should be disposed of at a landfill or facility which is approved to accept it. Records concerning drywell cleaning and sediment disposal should be maintained.

DEFINITIONS:

"Stormwater" means runoff resulting from rainfall.

"Urban Surface Runoff" means other common water discharges such as fire hydrant flushing; potable water system releases; foundation or footing drains that are not contaminated by pollutants; naturally occurring seeps, springs, wetlands or riparian areas; non-agricultural irrigation water; individual vehicle washing; evaporative cooler discharge; air conditioning condensate; swimming pool releases; water well backlashing; and dust control watering.

“Effective Settling Capacity" means the volume resulting from the distance between the bottom of a settling chamber to the height of the overflow outlet.

"Heavy Use/Industrial" means areas exposed to manufacturing and industrial operations or large drainage areas which would generate additional sediment or debris loading to a drainage system. This includes high truck traffic and loading areas such as public right-of-ways, shipping facilities and truck docks except where hazardous materials are used, handled or stored.