

Underdrain Policy Recommendations

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Colorado Springs Utilities
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Prepared for:
Bobby Ingels, HBA Representative;
Brent Schubloom, Utilities System Extensions Section;
Steve Kuehster, City Public Works Department;

By:
Charles Morgan

Definitions

Active System - a section of perforated underdrain pipe, usually with trench dams (used to direct the water into the pipe), used to collect groundwater within the trench line.

Outfall - the point of discharge of groundwater from the underdrain system, typically into a storm sewer, a stormwater detention pond, drainage way, or waterway.

Passive System - a section of underdrain pipe that is not perforated and is solely intended to transport groundwater.

Perimeter Drain - a drainage system typically consisting of a gravel bed, perforated pipe and a fabric blanket placed around the perimeter of a building foundation or similar structure designed to collect ground water and prevent its entry into the structure. The perimeter drain is typically either connected to a sump pump, daylighted locally, or connected to an underdrain system.

Sanitary Sewer System (or wastewater system) - the combination of service lines, collection pipes, interceptor pipes and treatment facilities, as defined by the City Code, necessary to collect, treat and safely dispose of wastewater.

Stormwater System (or storm sewer system) - the combination of streets, stormwater lines, detention ponds, drainage ways, water ways and other feature that serve to channel and contain surface waters resulting from storm events in order to preserve and protect public infrastructure.

Underdrain Main (or sub drain) - pipe that is typically located in the same trench as a wastewater collection line at or below the collection line's elevation. One or more service lines may be connected to the main.

Underdrain Service Line (or lateral) - the pipe from a privately owned subsurface groundwater collection system extending to the Underdrain Main.

Underdrain System - consists of the connection point to the underdrain pipe from a perimeter drain service line to the outfall point. One subdivision or more may feed into an underdrain system that is lower in the drainage basin before it outfalls.

Background

A number of developing areas of Colorado Springs have been impacted by shallow ground water. Perimeter drains have been employed for decades, however its use accelerated when the VA & FHA began requiring perimeter drains around its financed homes in the late 1970s. As a consequence developers have been installing pipes on both private property and public rights

of way since approximately the late 1970s to transport the ground water from the building perimeter drains to the outlet point. These pipes have been called sub drains or underdrains. These systems are typically installed at the direction of the developer's geotechnical engineer and are required for development. In many cases, the property may not be developed and utilities may not be installed without a system to convey and manage groundwater.

Historically, Public Works has had authority and responsibility for surface water drainage. Utilities has had authority and responsibility for the wastewater collection and treatment system.

The Utilities participated in a number of discussions that began in 1977 or earlier and continued into the mid-1980s regarding concern over the impact of underdrain systems on inflow & infiltration (I&I) into the wastewater collection system. I&I was a major consumer of wastewater treatment capacity in the 1970s and 1980s and perimeter drains and underdrains were a significant potential contributor to the problem. It was also not uncommon to find a home's sump pump discharge connected to the wastewater service line, especially in older parts of the City.

A number of efforts have been initiated over the past several decades to resolve the issue of underdrain installation and operation with only limited success.

In 1977, the Utilities and the HBA discussed the interest in connecting the perimeter drains to the sewer system. This alternative was deemed unacceptable due to the impact of using treatment plant capacity to treat unpolluted groundwater. It was estimated at that time that the connection of the perimeter drains for 486 homes would use up all remaining capacity in the treatment plant.

In 1983, Utilities introduced changes to the City Code (12.5.702) to specifically prohibit the discharge of water from underground drains, sump pump discharges, natural springs and seeps, water accumulated in excavations or any other water associated with construction into the wastewater treatment system.

In 1985, Utilities and Public Works developed basic design criteria for the installation of new groundwater collection systems and established that Utilities would inspect underdrains installed in the same ditch as the wastewater pipe. Utilities and Public Works agreed to adopt an informal policy to jointly sign off on future proposed underdrains installed under a wastewater main when requested by an engineer designing an underdrain system. However, ownership of the underdrain system remained private.

In 1986, Utilities developed proposed cross sections for underdrain installations in the same ditch as a wastewater line. That same year a groundwater pipe for Villa Loma Park was disconnected from the wastewater system and redirected to

the storm sewer resulting in the reduction of 7,500 gallons per day (GPD) of reduced flow to the wastewater treatment plant.

In 1988, Public Works initially proposed a Groundwater Collection Facility Ordinance.

In late 1989, Public Works issued a new draft Subsurface Groundwater Collection Ordinance for review and comment.

In 2001, City Code Section 3.3.110 was added which prohibited the discharge of subsurface water onto the surface of any public street, sidewalk or right of way. It also required that the property owner obtain written permission from the City Engineer for conveying the subsurface water to a safe discharge point upon the street or public right of way.

The 2002 Wastewater Line Extension & Service Standards book included placement criteria for underdrains in the same trench as a wastewater line.

In 2003, a sub-committee of HBA, City Engineering and Utilities staff met to frame the problem and identify solutions. A number of deficiencies were identified that need to be addressed in order to properly manage an underdrain system:

- Ordinances and regulations governing use
- System master planning and sizing
- Mapping and asset tracking
- Design and construction standards (additional)
- Development review
- Inspection
- Maintenance
- Funding
- Liability.

Without a funding mechanism, the City and Utilities were unwilling to accept responsibility and maintain the systems. Utilities did not consider underdrain systems to be a responsibility of Utilities as there was questionable benefit and they are not directly related to a core service. The General Fund was also not in a position to fund the program.

In 2006, City Ordinance 06-86 was enacted. City Code Section 3.8.201.B.2 clarified that discharges of uncontaminated ground water, water from foundation or footing drains are generally not considered illegal discharges to the municipal storm sewer system.

Several parties are the beneficiaries of the use of underdrains.

- Developers and Colorado Springs Utilities benefits from the resulting dewatering of utility trenches. This reduces disturbance of the pipe bedding around wastewater collection lines and issues with pipe floating in

the trench, reduces the potential inflow & infiltration of groundwater into the wastewater collection system requiring treatment, and reduces the potential for illegal discharge connections from sump pumps to the wastewater system. With modern pipeline construction technology, there is diminished benefit to Utilities from an I&I perspective since new collection systems are sealed and air tested, resulting in a very tight system in newer installations.

- Developers and builders benefit through dewatering around building foundations and subsurface infrastructure, allowing construction to proceed and owner financing to be obtained. An underdrain system may also be installed as insurance against future groundwater problems in a new subdivision if groundwater tables change due to drought or other developments.
- Homeowners and businesses receive a long term benefit in reducing the potential for damaging water infiltration into substructures.

The exact extent of underdrain systems in public rights of way is unknown. The installations have been included on wastewater plan submittals since approximately the early-1980s. No mapping system or comprehensive records have been maintained by the Utilities or City of past completed installations other than a summary of installations for a five year period documented in Appendix II. Estimates vary from 260 miles to over 400 miles of underdrains.

After almost 30 years of discussion the core issues of underdrains remain unresolved. The core issues are:

- Who is responsible for maintaining and repairing underdrains in public right of way?
- How will maintenance and repairs be funded?
- Who will maintain records on underdrains?

As these facilities age it has become increasingly urgent to establish the entity responsible for ongoing maintenance, operation & repair of these systems. A well designed and properly installed system should last for more than 50 years since it is an unpressurized system. The lack of standards and oversight for many of the initial underdrain installations makes a realistic life expectancy difficult to determine.

If the underdrain system fails or is damaged, the typical consequence is that a basement in the lower part of the basin backs-up with groundwater. Back-ups and system failures usually appear during wet periods or during Colorado's monsoon season.

The frequency of problems with underdrains is also difficult to quantify. No comprehensive records have been maintained over the years. A rough estimate

is that anywhere from zero to 4 occurrences are brought to the attention of the City or Utilities each year.

In 1983, a homeowner on Whitehorn Dr. in Anderosa Estates contacted the City & Utilities about concerns with a potentially failed underdrain system.

In 1999, a section of underdrain installed in Woodmen Road in the Peregrine subdivision was discovered to have collapsed and required replacement.

In 2006, there was an underdrain system failure on Grand Prairie Drive and the home builder took responsibility for the repair and corrected the problem. The home builder brought the issue to the Housing and Building Association (HBA) and a subcommittee of City and Utilities staff met to review the issue. HBA representatives recounted several recent failures including 2 in the Briargate area, 3 in Norwood (1 of which was a cross connect with the wastewater line), and 1 in Stetson Hills.

While relatively infrequent, these failures can be expensive to repair due to the depth of the installations and the location of other utilities in the right of way, including electric, gas, water, wastewater, storm sewer, cable, telephone and other fiber optic providers. Excavations to the underdrain level often require trench wall shoring and shoring or securing the other utilities encountered in the trench. If rodding or cleaning doesn't resolve the problem, point repairs could easily exceed \$10,000 and the replacement of sections of pipe could be much higher.

Existing Policy

Colorado Springs Utilities has had specifications in place since approximately 1997 to assure proper separation of underdrains from wastewater pipes and to establish acceptable clean out locations when the drain occupies the same trench as a wastewater line. Underdrain clean outs were allowed inside the sanitary sewer manhole until 2002 when they were moved outside the manhole due to concerns over cross-connections and spills.

Standards require that the developer include any active or passive underdrain system within the public right of way on the wastewater plan submitted to Utilities and the City for plan review/approval.

Since approximately 1985, City Engineering has approved the location and outfall of underdrains and Utilities has also approved the location of underdrains relative to wastewater lines. Utilities also inspects the installations as part of the wastewater line installation inspection.

Neither the City or Utilities accepts ownership, maintenance or repair responsibilities for underdrains. Ownership, maintenance and repair currently resides with HOAs, special districts, developers or individual property owners.

This approach is consistent with that of many other front-range Colorado communities (see Appendix I).

Issues and Opportunities

The following is a summary of frequently voiced questions over the decades:

- *Is the problem of sufficient magnitude for regulation and oversight by the City or is the issue insignificant?* In this case the "test of time" would indicate that the issue needs to be resolved. The need to resolve ongoing design, installation, ownership and maintenance issues has arisen several times over the past 30 years. It often is a surprise to homeowners that piping is installed around their building's foundation and connected to an underdrain pipe in the street with no clear ownership and maintenance responsibility. If a failure occurs they may be responsible for repair costs which can easily reach thousands of dollars just on their own property.
- *If underdrain systems are installed, who gives final design approval, who will inspect them and who will maintain them?* The current review process by the City and Utilities has evolved over the past decade to better address this issue, primarily due to the potential impact that poorly designed or installed underdrain can have on other public infrastructure.
- *Would lowering a water table in a given area or diverting water with an underdrain system create any water rights problems?* Use of water produced from an underdrain: Under Colorado Water Law, the use of water in the state is governed by the prior appropriation doctrine. This applies to surface water and groundwater alike. As subdrains intercept and deliver (produce) groundwater to the land surface, any beneficial use of this water (such as irrigation, cooling towers, etc.) is subject to Colorado Water Law. As such, the use would have to be allowed by an adjudicated water right including an augmentation plan, and in most cases would need to be permitted as a well. Under the law, the only legal use of an underdrain absent a water right and well permit is to discharge all of the water produced back to the natural stream system - either to a natural drainage or the storm drain system. Colorado Springs Utilities has a blanket Augmentation Plan water right (Case No. D2-89CW36) that provides the legal right to produce and use groundwater within the corporate limits of Colorado Springs, including water produced from underdrains. This is administered through the Augmentation Tariff. Utilities would be willing to work with a developer in putting the subsurface water to beneficial use for non-potable purposes such as irrigation if it is economically feasible.

Water rights implications from lowering the water table: A person has a right to protect property from damage caused by subsurface water but does not have the right to injure a water right or to put the water to beneficial use without a valid water right. These two issues however, are

covered under different areas of law. If a subdrain is being operated properly, with no beneficial use of the discharged water, and it lowers the water table to a point where another groundwater or surface water user receives less water than it otherwise would have, then a valid argument can be made that the underdrain has caused injury to that water user under Colorado Water Law. However, the law is not fully developed on this issue, and issues in this grey area of law would likely have to be resolved on a case by case basis through litigation. In most situations such as this which may arise within the City limits, Utilities is likely the affected party because it is the primary holder of water rights within the City Limits, with some exceptions. Given this, it is unlikely that underdrains within the City Limits, if operated legally, will create any significant water rights issues.

- *How can accidental connections of foundations drains to the wastewater system and wastewater service lines to underdrains be prevented?* Utilities has requested that the pipe used for underdrain in the same ditch as a wastewater pipe be of a different size than that used for wastewater collection pipes. It is also inspected upon installation.
- *What is the appropriate demarcation point between the subsurface collection system of a single property owner and the underdrain system?* Those portions of the system installed on private property should clearly be the responsibility of the property owner. This responsibility could be extended to the saddle connection point of the service line from the private property to the underdrain main in the public right of way. Since there is no curb stop or similar demarcation point, this treatment would be consistent with the handling of wastewater service lines to a property.
- *Who should establish and maintain the records of underdrains on public property?* Both the City and Utilities use the same mapping system and could establish and maintain such records subject to adequate funding

Proposed Approach to Existing & Future Underdrain Installations

For underdrains installed on public property, designate an entity, or entities, to:

- Maintain or maintain and own future underdrains,
- Establish and maintain specifications, standards, and warranties for underdrains,
- Evaluate the proposed system sizing and interconnections,
- Approve the proposed use, placement, design and outfall of underdrains,
- Inspect the installations,
- Maintain records for new installations and document preexisting installations as records and time permit,
- Conduct maintenance or repairs as necessary, and

- Establish funding mechanisms for these activities and responsibilities.

For existing underdrain systems:

- The current property owners connected to the system, the designated HOA or improvement district or other previously established entity retain ownership.
- Specifications, Standards, Warranties - any repairs or replacements should conform with current City or Utilities specifications and standards unless waived.
- Any changes to the size or placement of existing underdrains should be reported to the entity retaining the records.
- The cost of any necessary maintenance or repairs are the responsibility of the owner(s). The City or Utilities may elect to complete repairs and bill the owner(s) when public infrastructure is at risk.

For underdrain systems in new developments:

- The developer will submit plans for approval by the City and Utilities, if in a common trench with a wastewater line, and pay a review fee.
- The developer will be responsible for the cost of design and installation of the system.
- The developer will pay a fee for each residential or commercial lot in a subdivision with an underdrain system to pre-fund future maintenance and repair costs.
- The system installation will be inspected by the City or Utilities and, upon acceptance, ownership of the main will be conveyed to the established entity for the underdrain system located within public property, excluding lateral lines to individual parcels.
- The entity installing the underdrain system will warranty the installation for a 2 year period.
- Establish the identity of the owner of the underdrain system with regards to its ultimate replacement, as required.
- The designated public entity will maintain and repair the portions of the underdrain system on public property.

For existing development requiring an underdrain system:

- The property owners affected by subsurface groundwater will be subject to the same responsibilities as if it were a new development requiring an underdrain system.

Ownership Options Considered

("Ownership" refers to the responsibilities summarized above under the heading "For underdrains installed on public property, designate an entity, or entities, to:")

Option 1 - Require a responsible party, such as an HOA or district to be designated as the entity responsible for any underdrains located in public rights of way in perpetuity.

Pros

- Similar approach used by many front range communities

Cons

- No guarantee that the responsible entity will be in existence or financially viable when repairs are needed.

Option 2 - Include the underdrain infrastructure (mains) in public rights of way as part of the Utilities wastewater collection system.

Pros

- Provides strong control over its design, installation & maintenance.

Cons

- Additional design review staff needed.
- Completely separate infrastructure from the wastewater system.
- Utilities Bond ordinances likely would prohibit the accrual of new development fees in escrow for future maintenance or repairs of the system.
- Would likely require a rate increase to provide funding for maintenance.

Option 3 - Include underdrain infrastructure in public rights of way as part of the City Stormwater system.

Pros

- Provides strong control over its design, connection to the stormwater system, installation & maintenance.
- Maintains control over system and connections that may affect the City's stormwater discharge permit.

Cons

- Additional design review staff needed.
- Would likely require a stormwater fee increase to provide funding for maintenance.
- Results in potential duplication of development-related inspection resources between the City & Utilities.

Option 3a - Include underdrain infrastructure in public rights of way as part of the City Stormwater system. Utilize Utilities crews for initial inspection, maintenance & repairs until the City Stormwater Enterprise is prepared to take over this responsibility.

Pros

- Provides strong control over its design, connection to the stormwater system, installation & maintenance.
- Maintains control over system and connections that may affect the City's stormwater discharge permit.
- Provides a transition period while the stormwater enterprise builds staff and resources.
- A reserve fund could likely be established from new development fees for future repairs.

Cons

- Additional design review staff needed.
- Would likely require use of stormwater fees in the long term to provide funding for maintenance.
- Results in potential duplication of development-related inspection resources between the City & Utilities.

Option 3b - Include underdrain infrastructure in public rights of way as part of the City Stormwater system. Utilize Utilities' staff for development review and initial inspection, and acceptance for new development. Maintenance & repairs will be performed by the City Stormwater Enterprise.

Pros

- Provides strong control over its design, connection to the stormwater system, installation & maintenance.
- Maintains control over system and connections that may affect the City's stormwater discharge permit.
- Provides a transition period while the stormwater enterprise builds staff and resources.
- A reserve fund could likely be established from new development fees for future repairs.

Cons

- Additional design review staff needed.
- Would likely require use of stormwater fees in the long term to provide funding for maintenance.

- Leverages existing inspection processes during installation; eliminates duplication of effort. Smaller incremental inspections costs.

Recommendations

(TBD)

Implementation Steps

- Seek legal and financial review of the viability of the proposed approach(es).
- Seek internal and external approval of the proposed policy direction.
- Develop and implement appropriate design standards and material specifications.
- Resolve additional implementation details, including:
 - Ownership and maintenance responsibilities for underdrain mains located beneath a private street
- Implement a mapping and records system for new underdrain systems
- Establish inspection criteria and warranty coverage.
- Establish an initial design review, records and inspection fee. (See Appendix III)
- Establish a development charge or fee to provide funding for future maintenance and repairs. (See Appendix III)
- Develop a policy for City Council approval regarding responsibility for failures of systems installed in past years.

Summary

(TBD)

APPENDIX I

Underdrain Practices in other front range Colorado communities

Information was collected in 2003 regarding the handling of underdrains in other front range communities.

Broomfield – Allow underdrains with approval of the City Engineer. The city does not maintain underdrains.

Castle Rock – prohibits underdrains

Jefferson County – underdrains required in certain geologic areas and preferred in other areas. Plan submittal includes specifications, design, maintenance plan and entity designated to maintain the system, which is recorded. The county does not maintain underdrains.

Larimer County – Allow underdrains subject to established design and construction criteria. The systems are owned and maintained by private party, developer, or other assigned entity.

Parker - prohibits underdrains

APPENDIX II
Data on Underdrains in Public Rights of Way within the City of Colorado Springs

Data was recorded on the total footage of underdrains installed from 1982 to 1987. Specific records have not been maintained since then, however the systems have been documented on wastewater plans submitted by developers to the Utilities.

Year	# of Systems	Total Footage	Ave. Footage/System
1982	12	16,665	1,389
1983	29	128,762	4,440
1984	24	58,551	2,440
1985	16	53,585	3,349
1986	26	74,112	2,850
1987	10	23,004	2,300
Totals	117	354,679	3,031

From 1977 to 1981 there may have been an additional 80,000 feet installed assuming an average of 15,000 feet per year.

2006 Wastewater Collection and Underdrain System Data					
Wastewater System Footage	# of Wastewater Projects	# of Wastewater Projects with Underdrains	Underdrain Footage 6"	Underdrain Footage 4"	Total Underdrain Footage in ROW
187,458	116	47	71,896	28,478	100,374

From 1988 to 2006 there may have been up to 1 million feet installed assuming an average of 53,000 per year.

Total estimated mileage of underdrains through 2006 – 275 miles.

APPENDIX III Potential Fees and Funding Sources

Underdrain Plan Submittal Fee - recover the cost of plan review, outfall approval, and establishing the initial system records and mapping. This fee may be based upon the total pipe length, number of proposed connections or a flat fee.

Underdrain Inspection Fee - recover the cost of inspection from the point of connection of the service line to the underdrain to the outfall point. This fee may be similar in structure to the inspection fee.

Underdrain Development Fee - to provide funds to be reserved for future maintenance, repair or replacement needs. This fee may be established on a per connection basis or the size of the service line pipe or it may be a flat fee per lot on a development plan submittal.