



High Line Canal, Cherry Hills Village

Irrigation Pilot Study

The City of Cherry Hills Village and Denver Water are investigating the possibilities of drip irrigation for tree and shrub plantings along the High Line Canal. The City has agreed to fund a pilot study reach north of Belleview Avenue. This report summarizes embankment stability measures, irrigation system design, and system operations for the pilot reach irrigation installation.



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Introduction

ICON has completed the Irrigation Pilot Study for the High Line Canal. The study includes Embankment Stability, Irrigation Design and Operations. The Embankment Stability includes the alignment, trench design, max failure analysis and varmit protection. The Irrigation Design consists of a bubbler based irrigating system for newly planted trees. The Operation of the system will include regular maintenance, observation, and operation task completed by City Staff.

Embankment Stability

The pilot reach includes several design elements intended to maximize stability of the embankment in the unlikely event of an irrigation system failure.

Alignment: The irrigation line is intentionally aligned at the landside crest or toe to provide the maximum undisturbed embankment for the hydraulic loads from the canal. As shown in the cross sections, this alignment provides horizontal and vertical clearance to the hydraulic loads in the canal.

Max failure analysis. Estimation of the max potential energy from a pipe failure leads to a maximum potential failure volume for any given irrigation zone in the pilot reach. This is based upon limited irrigation zone lengths which limit the volume of water in any given leak. This is based upon gross assumptions of single point, instantaneous, full volume leak impacting native soils without any trench protection. The result of this analysis indicates there is a minor percentage of the embankment that is threatened should a pressurized failure occur.

Trench design: To protect against the highly unlikely event assumed in the max failure analysis, the trench design includes several redundant measures to protect the embankment: single trench installation, scour arresting geotextile, and an underdrain. The single trench installation minimizes the footprint of disturbed soil within the embankment. The scour arresting geotextile secures any breach of the pressurized system within the self-compacting, non-consolidating, highly permeable washed gravel backfill within the engineered trench section. The underdrain releases the break water in a slow, controlled, and identifiable location. All of these elements combine to ensure that any break in the pressurized system does not impact the embankment, is quickly identified, and easily repaired.

Varmit protection: The valve boxes and underdrain daylight locations are secured to prevent varmit intrusion. Valve box lids will be sealed with silicone and underdrain outlets will be fitted with grates. Further, pest control professionals will be consulted to include proper varmit poisons



within the valve boxes to ensure any burrowing pest that does enter the system is not provided a sustainable habitat.

Irrigation Design

The proposed irrigation system will consist of a bubbler-based system irrigating newly planted trees. Each tree will have a single 0.5 gallon per minute bubbler. All trees will be located on the west side of the Highline Canal Trail.

The proposed irrigation system will originate from an existing Cherry Hills Village irrigation mainline at intersection of Belleview Ave. and the Highline Canal. From its connection to the existing mainline the new mainline will extend approximately 1000 linear feet in a northerly direction as part of the Phase 1 project limits.

Electric irrigation valves will control water flow to the individual zones that irrigate the trees. Expected flows will be in the 10-20 gpm range. Only one valve will be in operation at any given time during an irrigation cycle.

The system will be controlled via an irrigation controller. The control system will incorporate a flow sensor and master valve at the origination point for the new mainline.

The flow sensor and master valve provide a method of monitoring flow rates and act as a safety system for the irrigation system. If excessive flow or unauthorized flow is detected by the flow sensor (indicating a problem with the system), the controller will deactivate (close) the master valve and shut-down water to the entire system. The normally closed master valve (i.e. valve is in closed position unless activated/opened by the controller during an irrigation cycle) will provide another safety device during times when the irrigation system is not operating as the valve remains closed and prohibits water from flowing in the new mainline. Additionally, a rain sensor will be installed at the controller location. The rain sensor will be another safety device to ensure irrigation does not occur during or immediately after a rain event.

It is proposed that the irrigation system be operated during day hours, in contrast to typically recommended night hours watering. As the bubbler system will incur minimal evaporative water losses, the day time watering schedule day time operation will allow the trail users to be additional sets of eyes to notice any malfunctions (broken lines, missing bubbler nozzles, etc.) and to notify Cherry Hills Village of these problems.



Lastly, estimated quantities of major irrigation equipment and materials for the test site will include: 1) 1000 l.f. 2" PVC mainline, 2) 750 l.f. 1" PVC lateral piping, 3) two electric valves, 4) one master valve, 5) one flow sensor, 6) one electric controller with rain sensor,, 7) three quick coupling valves, 8) one pressure reducing valve, 8) 1000 l.f. two-wire cable, 9) twenty bubblers and 10) two gate valves.

Operations

The Cherry Hills Village Staff will have a standard operating procedure in place for morning and afternoon line inspections during the irrigation season (April-October). It will be expected that City staff will inspect the test section once or twice per week, depending on the amount of time irrigation is running to the planted trees.

Irrigation restrictions: Cherry Hills Village will agree to shut down the main irrigation system valve during times where the High Line Canal is running water. Doing this will ensure there is no threat to the embankment when the failure risk is highest. This restriction will be documented in a standard operating procedure.

Leak detection: Cherry Hills Village staff will periodically (up to twice per week) visually inspect irrigation system. Additionally, Cherry Hills Village will place signage along the trail to inform users of the canal that there is live irrigation that has the potential to break and/or leak. The signs will provide trail users a hotline phone number to report leaks or other concerns with the irrigation system that will be installed along the pilot reach.

Conclusion

The City of Cherry Hills Village seeks authorization from the Denver Water Department Recreation Division for April 2013 installation of the irrigation system proposed in the Pilot Reach shown in the appendix. The City and Denver Water will monitor the pilot reach for the 2013 irrigation season. In November 2013, the City will submit to Denver Water a follow-up report detailing the results of the pilot reach operations.



Appendix

Plan View

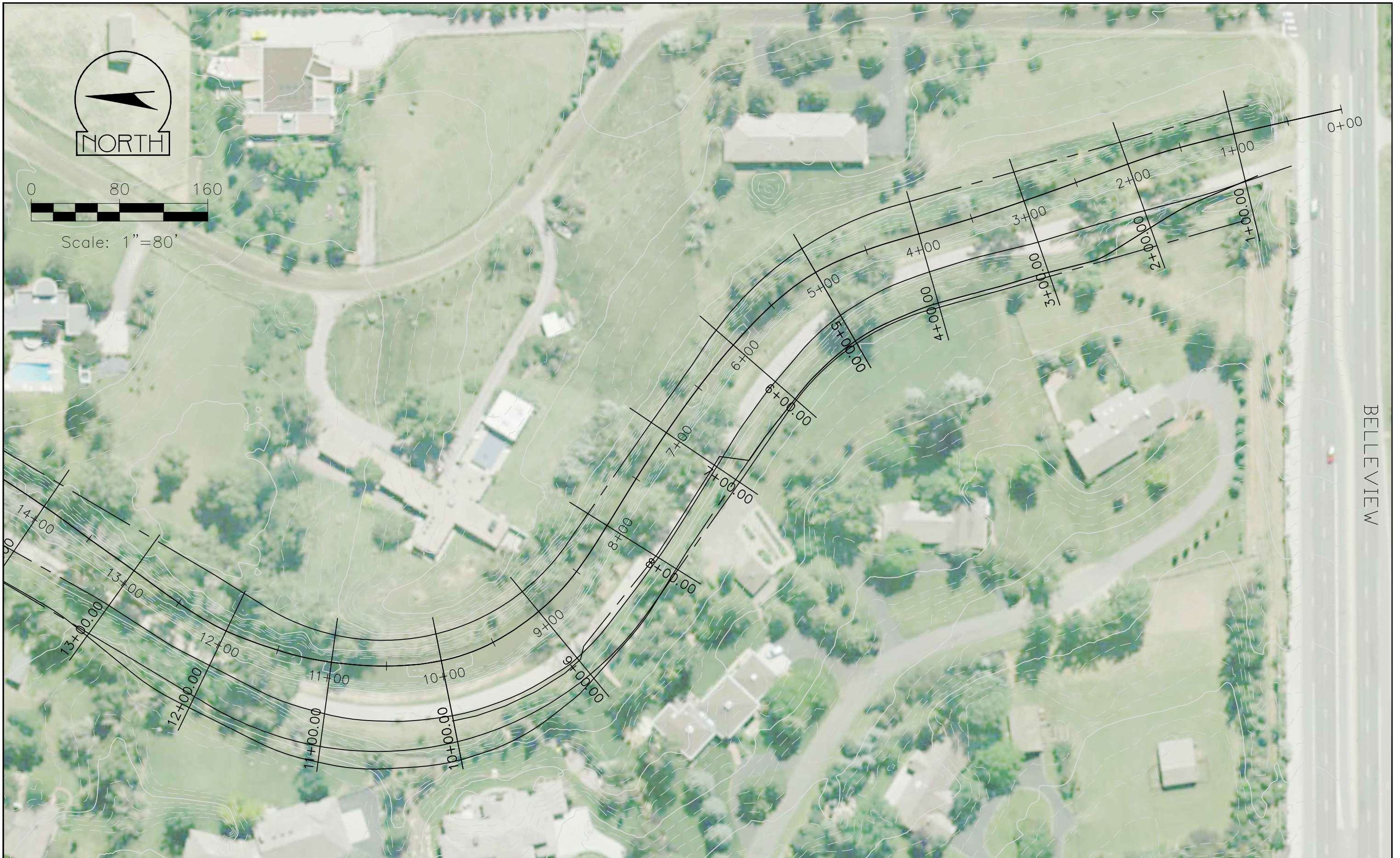
Cross Sections

Trench Cross Section A

Trench Cross Section B



Scale: 1"=80'



BELLEVUE

No.	DATE	REVISIONS
###	###	###
###	###	###
###	###	###
###	###	###

APP'R.	DESIGNED	CHECKED	PLAN	UTILITIES
###	###	###	DRAWN	RESEARCHED
###	###	###	DRAWN	DRAWN
###	###	###	CHECKED	CHECKED

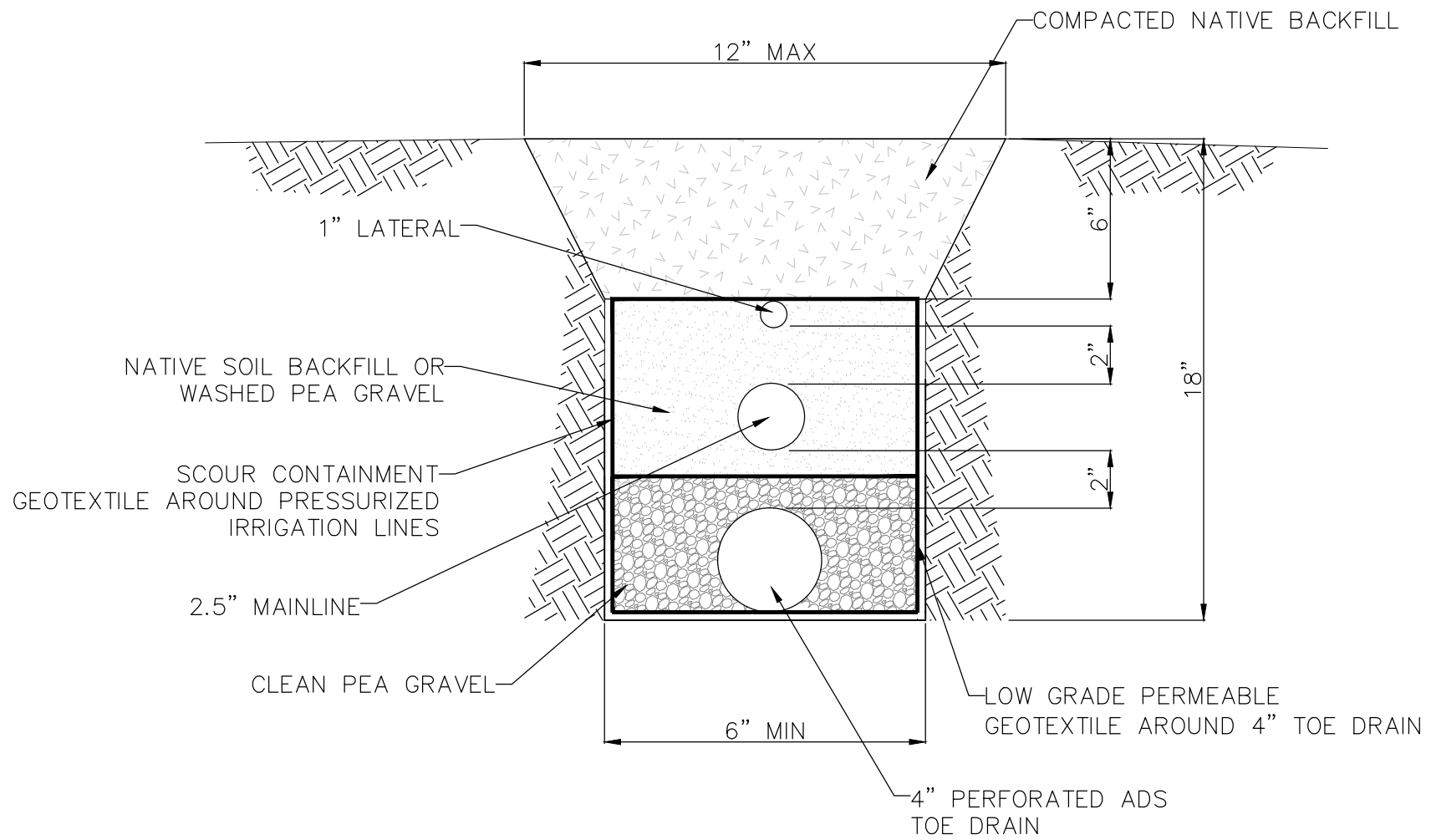
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ICON PROJECT No. 12-007-030-415

**HIGHLINE CANAL IRRIGATION
 PILOT REACH
 STA. 0+00 TO 10+00**

DATE
MAR 2013
 SHEET
1

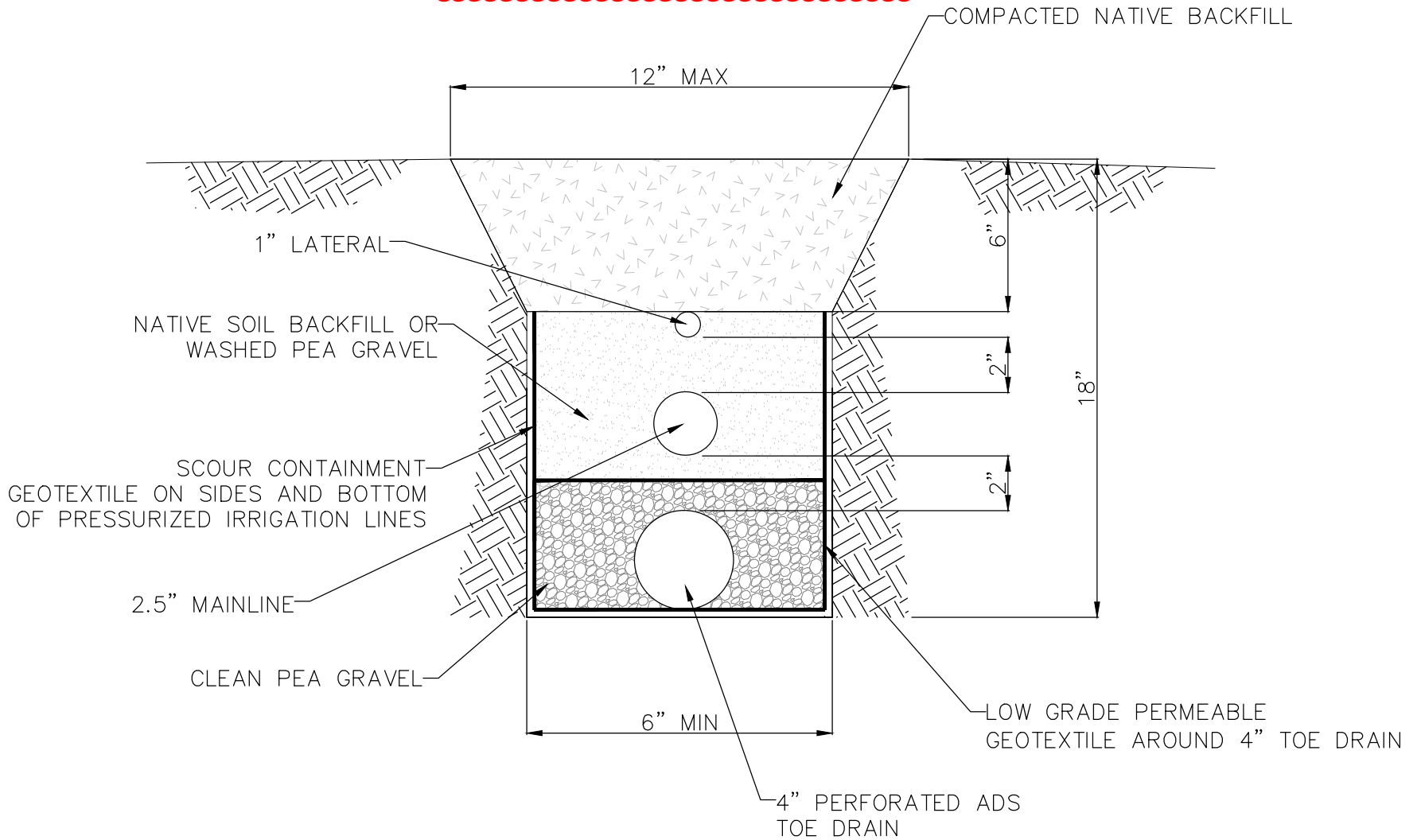
Trench Cross Section A
Full Geotextile Containment



TYPICAL SECTION DETAIL

SCALE: N.T.S.

Trench Cross Section B
Partial Geotextile Containment



TYPICAL SECTION DETAIL

SCALE: N.T.S.

