

# The City of Cheyenne's Lower Capital Basin Sediment Trap and Wetland Section 319 Project

December 18, 2017

This project was conducted in cooperation with the State of Wyoming and the United States Environmental Protection Agency, Region 8, State of Wyoming DEQ, and the Laramie County Conservation District.

State Project Number: NPS2013C

Grant Number: C900863013

E. coli

Recreation

Sediment

Storm Water Wetlands

Urban Run Off

## Section 1.0 Executive Summary

Pumphouse Wetlands

Construction Began: February 22, 2017

Completion: October 15, 2017

BUDGET SUMMARY	
Total 319 or 205(j) Funds Awarded	419,600.00
Total 319 or 205(j) Funds Expended	419,600.00
Total Nonfederal Match Commitment	1,065,277.00
Total Nonfederal Match Expended	1,514,280.34
Total Project Budget	1,484,877.00
Total Project Expenditures	1,933,880.640

This project was designed by Smith Environmental Engineering, Dacono Colorado in 2016. The primary goal of the project was to reduce sediment loading of Crow Creek, identified in Wyoming's 303(d) list as impaired for recreation, fisheries, and/or aquatic life. Per the TMDLs for Crow Creek, the primary source of pollutants causing the impairments is urban runoff from the City of Cheyenne. The Lower Capitol Basin (See map of drainage basin in Section 12), a fully developed basin including the historic downtown and near west side areas within the City of Cheyenne, discharged directly into Crow Creek via an 84" pipe. This project was designed to divert flows from the 84" storm sewer pipe thru a forebay and wetlands treatment area to reduce sediment flowing into Crow Creek through this discharge. A secondary benefit of the project design was to slow the water down through the wetlands to expose the water to ultra violet light to reduce *E. coli*. During design and soils investigation contaminated soils were encountered in the site, the City of Cheyenne entered a Voluntary Remediation Program with the State of Wyoming DEQ Department to remove some soils and cap the remaining.

The project was built as a park and contains a direct connection to the Cheyenne Greenway System. Within this park area is a historical Pumphouse which citizens of Cheyenne hope to renovate in the future. Although the park remains closed at this time to allow for the vegetation to establish. We hope to open the park to the public next spring.

The build out of the project cost \$1,537,443.70. Reiman Corporation of Cheyenne Wyoming was the general contractor.

Water quality monitoring of the site in July 2017 indicated that fecal coliform levels at the inlet were 96CFU (Colony Forming Units) and were reduced to 18.7 CFU at the outlet. TSS (Total Suspended Solids) were 16.4 mg/L at the inlet, and 2.0 mg/L at the outlet. The monitoring indicates the project is performing as designed. Please see the Cheyenne Board of Public Utilities report in Section 12.

## Section 2.0 Background

Six segments of Crow Creek through the City of Cheyenne have been listed on Wyoming’s 303(d) list as impaired for recreation, fisheries, and/or aquatic life designated uses. (summarized in the table below) Per the developed TMDL’s for Crow Creek, the primary source of pollutants causing the impairments is urban runoff from the City of Cheyenne. Urban nonpoint source pollution comes from a number of sites and activities within the urbanized center. Sediment comes from construction sites, unpaved alleys, and streets. Excess sediment levels in streams negatively impacts the aquatic community. Sources of bacteria include pet waste, urban wildlife, and illicit sanitary cross connections to storm sewer systems. Exposure to elevated levels of bacteria in waters used for recreation can be human health concerns.

Table 1

Identifier	Extent	Use	Impairment
WSP101900090107-01	From inlet of Hereford Reservoir #2 upstream to outlet of Hereford Reservoir #1	Recreation (Not Supporting)	E. coli (1996)
WSP101900090107-02	From 0.7 miles below Morrie Avenue downstream to the inlet of Hereford Reservoir #1	Non-game fishery, Aquatic Life and other than Fish (Not Supporting)	Sediment (2012)
WSP101900090107-02	From 0.7 miles below Morrie Avenue downstream to the inlet of Hereford Reservoir #1	Recreation (not Supporting)	E. coli (2012)
WSP101900090107-03	From Morrie Avenue to a point 0.7 miles downstream	Non-game fishery, Aquatic Life and other than Fish (Not Supporting)	Sediment (2010)
WSP101900090107-03	From Morrie Avenue to a point 0.7 miles downstream	Recreation (Not Supporting)	E. coli (2012)
WSP101900090107-04	From Morrie Avenue upstream to Happy Jack Road	Cold Water Game Fishery, Aquatic Life other than fish (Not Supporting)	Sediment (2012)
WSP101900090107-04	From Morrie Avenue upstream to Happy Jack Road	Recreation (Not Supporting)	E. coli (2012)
WSP101900090107-05	From Happy Jack Road upstream to Roundtop Road	Recreation (Not Supporting)	E. coli (2012)
WSP101900090203-01	From Missile Drive (HWY217) upstream to the outlet of Hereford Reservoir #2	Recreation (Not Supporting)	E. coli (1996)

From 2010 to 2012, The Wyoming Department of Environmental Quality developed Total Maximum Daily Loads (TMDLs) for the segments. The TMDLs provided a detailed analysis of the sources of pollutants causing the impairments in Crow Creek and included an Implementation Plan with

recommendations to be taken by local stakeholders to address those sources. This project sought to implement those recommendations from the Crow Creek TMDL Implementation Plan to reduce sediment and *E. coli* loading of Crow Creek.

This project developed an approximately 2 acre storm water wetlands complex to capture and passively treat urban runoff from the Lower Capitol Basin of Cheyenne. The primary goal is to reduce the amount of sediment that reaches Crow Creek. A secondary benefit of the project is reduction of *E. coli*.

The 84" inch storm sewer pipe coming from the Capitol Basin has now been diverted into a forebay area with a weir wall at the far end. This type of design allows most of the sediment to settle out within the forebay area prior to going over a weir wall into the wetlands area. In the wetlands area the water is filtered through wetlands plantings to further clean the water as well as exposing the water to ultra violet light to help reduce any *E. Coli* which may be present in the water.

### **Section 3.0 Goals and Outcomes**

The primary goal of this project was to reduce sediment loading to Crow Creek to achieve load reductions identified in the TMDLs as being needed to allow Crow Creek to meet water quality standards. A secondary benefit of this project is to reduce *E. coli* loading to Crow Creek, also in accordance with the TMDL.

Although time has not allowed us to quantify the amount of sediment collected within the forebay area, a sediment bench is visually evident when observing the area from the top of the diversion structure. Water testing of the site in July of 2017 show benefits from the design for both sediment reduction and *E. coli* reduction. (These test results are provided in Section 12.)

**Section 4.0 Task Activities**

<b>Task #</b>	<b>Task Title</b>	<b>Task Description</b>	<b>Actual Deliverables</b>
<b>1</b>	<b>Administration</b>	<b>The City of Cheyenne will administer the project, submit for reimbursement requests, keep all records, file all reports, and obtain any necessary permits. Administration will cover life of the project</b>	<b>Reports and reimbursement requests were provided as needed.</b>
<b>2</b>	<b>Sediment Trap/Wetland Design &amp; Preparation of Construction Documents.</b>	<b>Collect necessary geotechnical and hydrological information, conduct geotechnical and hydrologic analyses, prepare 65% draft plans and cost estimates, prepare 95% draft plans and cost estimate, permit wetlands, and develop and present final plans and specifications.</b>	<b>Final Construction Documents, including plans, specifications, and cost estimates.</b>
<b>3</b>	<b>Construction of Facility in Accordance with approved construction Documents</b>	<b>Project bid management, bid award, construction management, and construction of the Lower Capitol Basin Sediment Trap/Wetlands project. Construction to include mobilization of Contractor and construction equipment to the project site, site preparation and excavation of the site, topsoil storage and later placement, planting of wetland species in accordance with the project construction documents, reseeding and any post construction erosion control. Project site has the potential conflicts that will need to be addressed in the design and construction of the project.</b>	<b>Project bid out through the City of Cheyenne Purchasing Department  Awarded bid to Reiman Corporation  Completed construction of facility. Approximately 2 acres wetland constructed.</b>
<b>4</b>	<b>Information/Education</b>	<b>One public meeting for the community towards the end of the design period to explain the purpose of the project, its benefits to the lower Capitol Basin and Crow creek watershed will be held at the 95% plan submittal period. A second public meeting will be held with a project tour at the completion of the project construction. Meeting times and locations.</b>	<b>First Public Meeting held 8-2-16 @4:PM at the Asher Bldg.  Second Public Meeting 10-30-17 at facility. 1:30PM to 3:00PM</b>

**Section 5.0 BMP Implementation**

<b>BMP Name/Description</b>	<b>HUC12</b>	<b>Date Completed</b>	<b>Targeted Pollutant</b>	<b>Load Reduction Estimate</b>	<b>Load Reduction Estimate Methods</b>
Wetland/Forebay	101900090107	October 2017	Sediment	160 to 493 Tons/year	The original load reduction estimate of 286-493 tons /yr was based on the Stormwater Center's Simple Method to Calculate Urban Stormwater Loads, the annual TSS loading from a three hundred acre medium density development will be on the order of 500,000 lbs or 5,200 cubic foot. Based on analyses from Smith Environmental, the constructed wetland is estimated to have a 70% removal efficiency for TSS. This estimate was based on the actual design of the wetland coupled with data from Crow Creek TMDL's and findings from Smith Environmental's SWMM model.
Wetlands	101900090107	October 2017	E. coli	25% or up to an estimated 1,200 CFU X 10 <sup>9</sup> per day.	Smith Environmental estimated a 91% removal efficiency for e.coli based on the actual design of the wetland coupled with data from Crow Creek TMDLs and findings from Smith Environmental SWMM model

## Section 6.0 Monitoring Results

No monitoring results are available at this time. Site observation is positive though. When standing on the top of the diversion structure one can see a large sediment bench already forming in the forebay area and none seen past the weir into the wetland area. Once water began to flow into the wetlands we received complaints from area businesses about a smell coming from the area. As *E. coli* is a problem in this area we asked our Board of Public Utilities (water department) to take water samples and check for raw sewage because of cross contamination concerns. The results were very positive and showed the wetlands are working as designed; furthermore, the monitoring provided no indications of raw sewage being present. Please see report in Section 12. The smell was determined to be coming from two possible sources, hydrogen sulfide being produced from the breakdown of sulfates in the water or the Biosal fertilizer being used.

This project originally included Task 5 for monitoring activities to evaluate environmental benefits of the project. The City originally planned to coordinate with Laramie County Conservation District for *E. coli* monitoring in Crow Creek and to conduct repeat annual cross section surveys of the accumulated sediment in the facility to estimate the volume of sediment in the facility, with expectations that retained sediment sampling to establish gradation of sediment in the facility, with expectations that retained material will largely consist of sand and fine gravel. Because of insufficient time between completion of the wetland (October 2017) to collect data to evaluate effectiveness of the project, Task 5 was removed from the project scope of work through an amendment approved in March 2017. Funds from task 5 were instead added to Task 3 to assist with construction costs. The City, however, plans to conduct the annual sediment evaluation next year and is anxious to see the results next fall. In addition, WDEQ Monitoring Program staff members have started and plan to continue efforts to monitor water quality in Crow Creek; these efforts will help evaluate the benefit this project has on Crow Creek.

## **Section 7.0 Partners**

Project partners included the United States Environmental Protection Agency, Region 8; State of Wyoming DEQ Department, and the Laramie County Conservation District.

Laramie County voters were very important partners in this endeavor as they supported the optional sixth penny sales tax which provided match monies for this project. Additional funding for this project was provided by Clean Water State Revolving Funds through the WDEQ.

## **Section 8.0 Information and Education**

Two public meetings were held to satisfy Task 4 obligations. One was held on August 2, 2016 at the completion of the design. A second meeting was held on October 30, 2017. Informational packets were distributed to all that attended the second meeting explaining how the new facility works and the benefits expected from its implementation. The local television station attended the second meeting and interviewed the City Engineer about the project. They produced a nice informative report on the local evening news.

## **Section 9.0 Complications**

During soils investigation in the design phase of the site it was found the soils in the project area were contaminated. A Voluntary Remediation Plan was entered into with the State of Wyoming DEQ. Four specific areas of the project site were found to have concentrations of polycyclic aromatic hydrocarbons (PAH) and /or total metals (lead, barium, arsenic) in exceedance with Wyoming Industrial Cleanup Levels. These areas were excavated first and the bottom and sides of excavations tested again to assure all soils exceeding cleanup levels were removed and hauled to Ault Colorado. General excavation of the site then began with all soils excavated being loaded and trucked to Waste Management Solutions Landfill in Ault Colorado. When all excavation of the site was completed we took more test in locations directed by State of Wyoming DEQ personnel to assure the remaining soils did not exceed Wyoming Industrial Cleanup Levels. A total of 17,000 tons of material was hauled to the Waste Management Solutions landfill in Ault, Colorado.

Another unforeseen problem we encountered was once the water began to flow into the site and began to sit in the wetland area mosquitoes became a problem for the businesses in the area. Wanting to help the area businesses, a call was placed to the City of Cheyenne Weed and Pest management office for help. As they are already certified to treat natural creek and drainage areas they began treatments to eradicate the midges. The Wetlands area is on a three-week rotation for treatment during the mosquito season. I am hopeful this problem will not be as severe in the future as it was during the buildout because we will not be irrigating the area to establish the different seeding and planting areas. Area businesses also complained about the smell coming from the area. After a little investigation it was found to be the Biosal fertilizer we were using. As the fertilizer was used up the smell dissipated and was no longer a problem.

At the present time the facility remains closed to the public in order for the plant material and seeding to become established. Of further concern is the areas within the site that present fall hazards which were not addressed during design. We will be keeping the area closed until these items can be mitigated with City funds.

## **Section 10.0 Recommendations**

One of the items which wasn't addressed is the amount of trash coming in with the storm water. This is a challenging issue in urban areas. After a significant rainfall the amount of water bottles and other urban debris coming in with the water is overwhelming. Trash has now deposited itself throughout the edges of the wetland and forebay areas where it will need to be picked up by maintenance crews. I would strongly urge trash mitigation is taken into consideration during design. I have spoken with our drainage engineer about the possibility of a trash interceptor at the last manhole prior to the outfall at the forebay but maintenance of such an item is in question. I will continue to work on a solution, meanwhile we will continue to pick up the trash.

**Section 11.0 Financial Summary**

<b>Task #</b>	<b>Task Title</b>	<b>319 or 205(j) funds Expended</b>	<b>Nonfederal Match Expended</b>	<b>Total NPS Expenditures</b>	<b>Other Federal Funds Expended</b>
<b>1</b>	<b>Project Coordination, Fund Management, Progress and Final Report</b>	<b>4142.93</b>	<b>2761.96</b>	<b>6904.89</b>	
<b>2</b>	<b>Sediment Trap/Wetlands design and Preparation of Construction Documents, Field Work, Geotechnical and Hydrologic Analysis</b>	<b>69,315.80</b>	<b>81,260.43</b>	<b>150,576.23</b>	
<b>3</b>	<b>Project Construction</b>	<b>346,141.26</b>	<b>1,430,258.25</b>	<b>1,776,399.51</b>	
<b>4</b>	<b>Education to keep public informed.</b>				

**Section 12.0 Attachments**

Map Capitol Basin Area

BOPU Water Quality report

Press Release – Open House, 2<sup>nd</sup>. Public Meeting

Sign in sheets Public Meeting #2

Informational Packet Second Meeting.

8th Avenue

**DRAINAGE AREA TO PROJECT**

**Snyder Avenue Storm Pipe**

Pershing Boulevard

**26th Street Storm Pipe**

Central Avenue

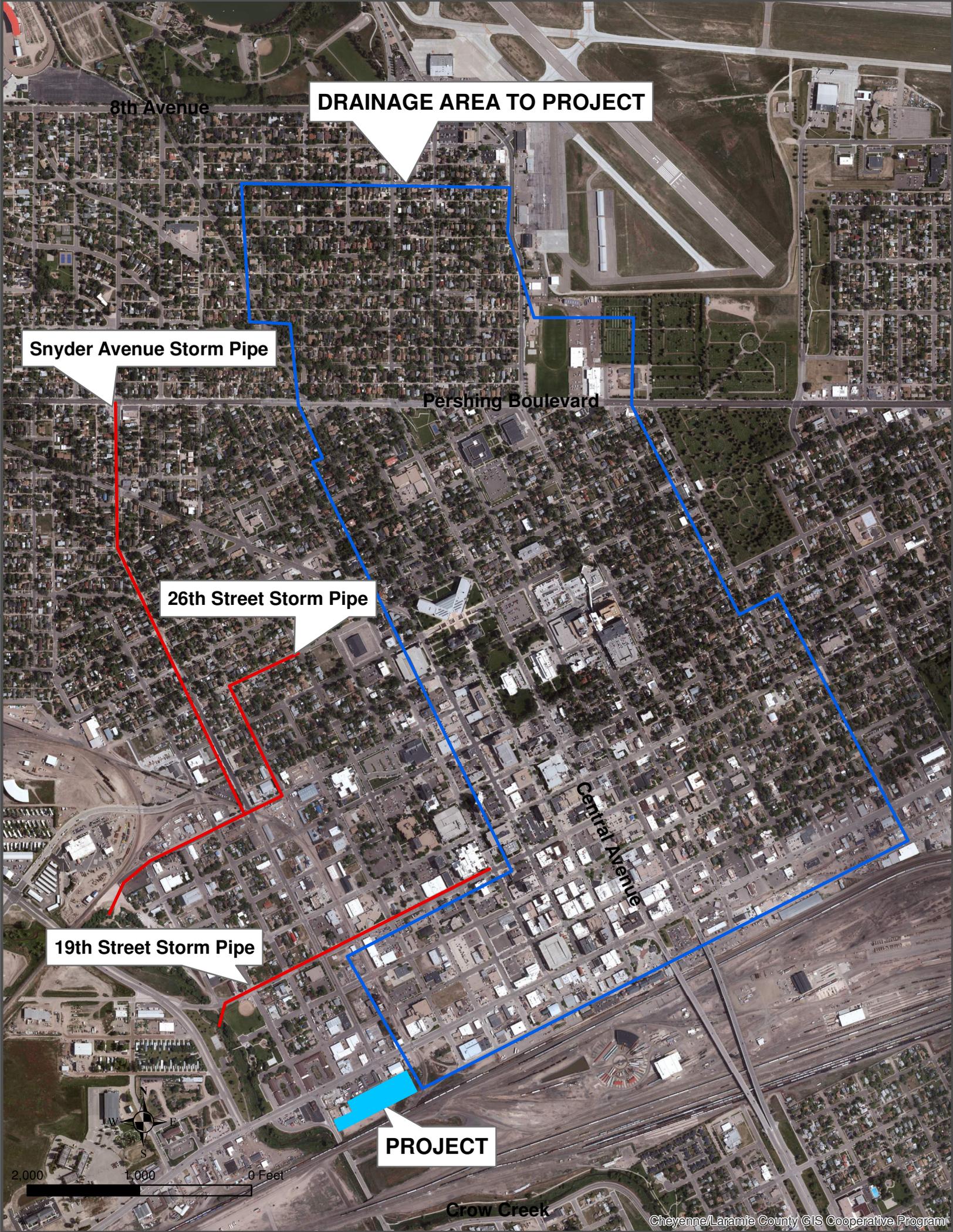
**19th Street Storm Pipe**

**PROJECT**

2,000 1,000 0 Feet



Grow Creek





# Board of Public Utilities

## Cheyenne Water and Sewer Departments

Board of Public Utilities Water  
Quality Test - Site is working!

2416 Snyder Ave  
P.O. Box 1469 (mailing)  
Cheyenne, Wyoming 82003

Phone (307) 637-6460  
[www.cheyennebopu.org](http://www.cheyennebopu.org)

August 18, 2017

To whom it may concern,

On July 18, 2017 the Board of Public Utilities (BOPU) Water Reclamation Division collected and analyzed water samples from the Pumphouse Park storm water diversion/ detention pond. The City of Cheyenne contacted the BOPU about odors coming from the storm water pond and were concerned about the potential of a sanitary sewer cross connection to the storm water system leading to the pond. We collected samples at the pond inlet, the shallow engineered wetland area, the outlet pipe leading to the small outlet pool, and the outlet pool itself. The attached diagram shows the approximate locations of the sampling points. Our findings are summarized below:

- Ammonia-N was less than 0.1 mg/L at each sampling point, indicating a low ammonia concentration, making the water more suitable for aquatic life.
- Biochemical Oxygen Demand (BOD) was 3.8 mg/L at the inlet and less than 3.0 mg/L at the three other sampling points, indicating that the organic “strength” of the water is very low, and decreases as it moves through the wetland. This is another indicator of good water quality.
- Fecal coliform levels were 96 CFU (colony forming units) at the inlet, 85 CFU in the wetland, 26.7 CFU at the outlet pipe, and 18.7 CFU at the outlet pool. *E. coli* presence followed a similar trend, decreasing as the water traveled through the engineered wetland. This indicates that the wetland is working as it should, and is decreasing Fecal Coliform and *E. coli* presence as it travels through the engineered wetland. Neither Fecal Coliform nor *E. coli* densities indicated the introduction of sanitary sewage into the storm water catchment. Fecal Coliform can be introduced from a wide variety of warm blooded animals, primarily birds (common wetland contributors would be ducks, geese, herons, etc). *E. coli* is normally introduced by mammalian sources such as horses, cattle, dogs, and humans. Since we are talking about storm water leading to a small wetland in this case, it is not at all unusual for there to be Fecal coliform and *E. coli* present.
- Total Phosphorus was 0.3 mg/L at the inlet, and 0.2 mg/L throughout the rest of the sampling points, indicating some break down of phosphorus through the system, thereby improving water quality.
- Total Suspended Solids (TSS) was 16.4 mg/L at the inlet, 3.2 mg/L in the wetland, and 2.0 mg/L in the outlet pool, indicating that the engineered wetland is functioning well as a filter for suspended solids removal.
- Sulfide was less than 0.025 mg/L (non-detected) at the inlet and in the wetland, 0.18 mg/L at the outlet pipe, and less than 0.025 mg/L (non-detected) in the outlet pool. What this means is that there are non-detectable amounts of sulfide present on the way into the pond, but sulfides are being produced near the end of the wetland. This is the sewage-like smell that people have been complaining about. The smell is most likely Hydrogen Sulfide being produced from the break-down of Sulfates present in the storm water. Sulfates can be produced from a wide variety of sources including the surrounding substrate, sediment, decaying organic material or even trash. There was a lot of trash (cans, cardboard, papers, etc) present in the pond, introduced from the storm sewer. Again, this shows that the wetland is functioning in breaking down the Sulfates and cleaning up the water, but it will produce some smells as it produces sulfides. The engineered

wetland is not yet well established, so as the aquatic vegetation continues to grow and the system matures, the smell may be less noticeable as the wetland breaks down organic material and absorbs nutrients from the storm water.

- We also performed a macroinvertebrate survey and found a healthy community of macroinvertebrates such as mosquito larvae, diving beetle larvae, mayfly larvae, Ostracods, Copepods and Hydra. The presence of mayfly and diving beetle larvae are bioindicators of fairly good water quality. If there was sanitary sewage present in this wetland, we most likely would not see those particular aquatic insect larvae. Crayfish were also present in the outlet pool.
- Finally, we witnessed no sanitary sewage solids (such as toilet paper, etc) at any point in the catchment. This is another indicator that a cross connection is unlikely.

Based on the above findings, we see no evidence of a sanitary sewer cross connection to the storm sewer leading to this storm water catchment. Our findings support the conclusion that the detention pond and engineered wetland are successfully doing what they are supposed to do, however they are likely to produce some odors while they do it.

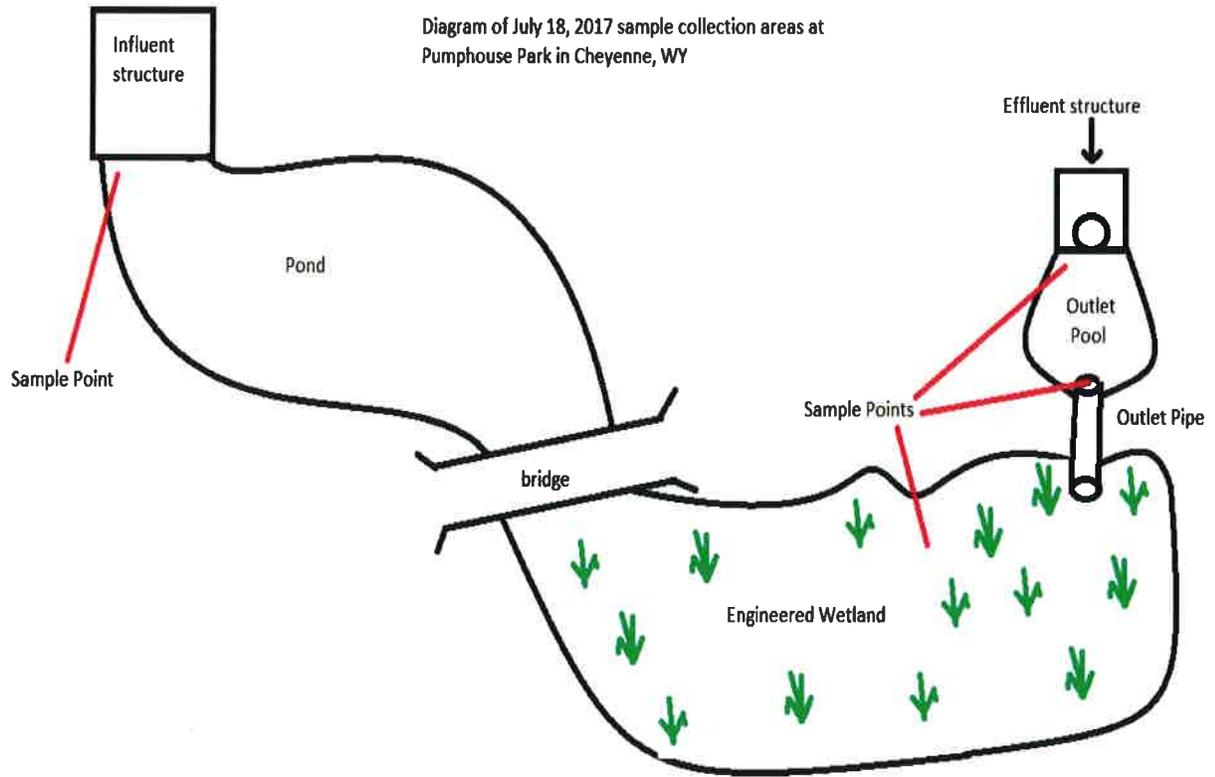
Please feel free to contact me if you have any questions about our findings.

Sincerely,



Nate Kie  
Water Reclamation Division Manager  
Cheyenne Board of Public Utilities

Diagram of July 18, 2017 sample collection areas at Pumphouse Park in Cheyenne, WY





# Press Release

2101 O'Neil Ave. Cheyenne WY 82001

Marian Orr, Mayor

**For Immediate Release  
October 25, 2017**

**Contact:**  
Jim Voeller  
City Engineer  
(307) 638-4314

## **Open House For Pumphouse Wetlands Project Is Scheduled For October 30**

**CHEYENNE** – The City of Cheyenne will hold an open house for the Pumphouse Wetlands Project on Monday, October 30. The wetlands is located at the end of Snyder Avenue, just south of West Lincolnway.

The open house will be held from 1:30 p.m. to 3 p.m.

The Pumphouse Wetlands Project was a volunteer remediation project by the city to help reduce sediment and E.coli in Crow Creek. Funding for this project came from the United States Environmental Protection Agency, State of Wyoming, and the City of Cheyenne sixth penny tax.

City staff will be at the open house to answer any questions.



Hand out from second meeting.  
"How the Wetland Works"

# Pumphouse Wetlands Project

15<sup>th</sup> Street & Snyder Avenue

*This is a voluntary remediation project to reduce sediment and E.Coli in Crow Creek*



**Design:** Smith Environmental & Engineering, Dacono, Colo.

**Cost:** \$1,726,168

**Funding:** EPA 319 Grant \$419,600

State of Wyoming, DEQ Grant \$250,000; Loan: \$750,000

City of Cheyenne Sixth Penny \$380,400

**General Contractor:** Reiman Corporation, Cheyenne, Wyo.

**Sponsor:** City of Cheyenne in cooperation with the State of Wyoming and the United States Environmental Protection Agency, Region 8

**Note:** *Over 17,000 tons of contaminated material was removed from the site which would tower 50 feet by 50 feet by 127 feet tall*

# How The Wetlands Works



**Diversion/Forebay Area:** Water containing sediment enters forebay area from 84" pipe coming from downtown. Sediment settles out in forebay prior to weir.



**Weir:** The water flows over the weir into the wetlands area.



**Wetlands:** As water moves thru the area, nature helps remove coliform and E.Coli present in the water.



**Micropool and Outlet:** Return cleaner storm water back to Crow Creek.