CASFM Project Awards Nominations 2012

Canal Importation Ponds and Outfall Design (CIPO)

AYRES ASSOCIATES

Project Information

Project Name: Canal Importation Ponds and Outfall Design (CIPO)
Project Location: City of Fort Collins, Colorado

Project Sponsors:
City of Fort Collins: Owen Randall, PE, Project Manager

Project Design Engineers:
Ayres Associates: Andrea Faucett, PE, CFM, Project Manager
Anderson Consulting Engineers: Brad Anderson, PE, CFM, Project Manager

Subconsultants: BHA

Contractor: Garney Construction

Construction Period: Built in phases from 2008 to 2011

Submitted by: City of Fort Collins, Ayres Associates, and Anderson Consulting Engineers

Construction Costs: $21.5 million

Primary Objectives:
- Provide flood control to protect nearly 200 homes and several roadways.
- Improve water quality treatment from runoff for 220 acres of urban areas.
- Provide wildlife habitat, recreation, and educational opportunities in the project area.

Construction Elements:
- Stormwater flows were intercepted before entering irrigation ditches and conveyed south via a 102-inch storm sewer through a series of five detention/water quality ponds. The design included redirecting the outfall for an existing pond to further reduce storm flows in adjacent ditches.
- A slide rail system was used for the first 1,300 linear feet of pipe installation in 24- to 32-foot depths. The slide rail system provided a safe, shored excavation and was compatible with the sticky clays that were encountered.
- A unique round version of the classic Bureau of Reclamation Type 10 hanging baffle structure for the final outfall from the 102-inch storm sewer achieved the same hydraulic function for energy dissipation but dramatically changed the look of the structure from the public's perspective. Artevia-colored Agilia concrete with a custom hand-carved form liner was incorporated into the structure's design, which created art on the hydraulic structure to take advantage of Art in Public Places funding that had been set aside for stormwater projects.
- Water quality was improved through construction of five water quality extended detention ponds within the project area. In the larger three of the five ponds, underdrain systems were designed and constructed to increase storage potential and eliminate the loss of groundwater/water table due to evaporation.
- Existing fox dens, shrubs, and trees were preserved where possible. The landform was sculpted to mimic the natural environment with varying slopes, undulations in the basin bottom, serpentine waterways, and careful consideration for views of structures and locations of existing fox dens and trees. The project was designed to require little maintenance and no supplemental irrigation after plant establishment. A soft surface loop trail encourages recreation and educational exploration around and through the stormwater basins.

Project Overview

The Canal Importation Ponds and Outfall (CIPO) project provides needed flood mitigation, water quality and habitat improvements, stream restoration, and opportunities for outdoor wetland education activities for the community of Fort Collins, Colorado. The $21.5 million project's key accomplishment is flood mitigation for nearly 200 homes and several roadways in an area immediately upstream of Colorado State University in the heart of Fort Collins. Despite the size of the project – five regional storm ponds, 4,500 feet of large-diameter (78- to 102-inch) concrete pipe, and 250,000 cubic yards of excavation – the project earned solid public support.

This project achieved its most important goal of providing reliable flood protection, but designers took advantage of the opportunity to accomplish much more. The project re-established a riparian stream corridor through the detention ponds to improve habitat and water quality for this tributary to Spring Creek. The regional detention/water quality ponds were treated as opportunities to restore natural areas to the urban setting.

Using its Alternative Product Delivery System (APDS), the City assembled a team in 2006 of two engineering consultants – Ayres Associates and Anderson Consulting Engineers – and general contractor Garney Construction to work in concert with the City. The team engaged in a year-long alternative analysis phase to investigate many potential solutions to reduce costs, improve habitat, and simplify construction. The original master plan design called for building vertical concrete walls on both sides of the ditches and a secondary box culvert along the west side of the ditches for irrigation flows. In contrast, the chosen alternative involved intercepting storm flows before they enter the ditches and conveying them south via a 102-inch storm sewer through a series of five detention/water quality ponds. The design included redirecting the outfall for an existing pond to further reduce storm flows in the adjacent ditches.

The design team implemented several innovative technologies to accomplish the goals of the project while maintaining public trust. For example, the team designed a round

Project Description

baffle structure, rather than the traditional rectangular-shaped structure, to slow the large volume of water at the final outfall so it would not create a scour hole in the pond. This dramatically changed the look of the structure and made it more aesthetically appealing. It also incorporated a custom hand-carved form liner, which allowed the City to use Art in Public Places funding that had been set aside for stormwater projects. The same form liner was used on all the visible hydraulic structures within the large project area to connect the spaces and give the project unity.

Additionally, great effort was made during the design to avoid creating traditional "bathtub" detention ponds. Instead, the team designed multipurpose facilities for flood mitigation, wildlife habitat, and public trails.

Extensive public outreach from the entire design-build team – which described the challenges and goals of the project – resulted in solid support for a highly visible and politically sensitive project. Efforts included newsletters, a web page, open houses, and daily face-to-face communication and coordination with the public.

Innovation changed this project from what could have been an unsightly drainage ditch to a solution that instead redirects excess flows underground and provides added value through natural areas that serve as flood storage, water quality treatment facilities, and wildlife habitat.

Judging Criteria 1: Enhancement of Public Health, Safety, and Welfare

The CIPO project's most important goal was to provide reliable flood protection for nearly 200 homes and several roadways that experienced flooding frequently. Flooding could have been mitigated by enlarging or increasing the capacities of the existing irrigation ditches. However, the team focused not only on solving the flooding problem but also on minimizing the effect on residents and maximizing the benefits to the environment.

Reducing Impacts to Residents

During the design phase, seven tunneling scenarios were developed to avoid 32-foot-deep excavations adjacent to condominiums and homes. Due to the depths of the excavations and the sticky nature of the semi-fluid sandy clays at these excavation depths, a slide rail system was proposed for the first 1,300 linear feet of pipe installation in 24- to 32-foot depths. Although construction with a slide rail system is slower than conventional trench box systems, it provided a safe, shored excavation.

In the larger three of the five ponds constructed, underdrain systems were designed and constructed to increase storage potential and eliminate the loss of groundwater/water table due to evaporation. Doing so eliminated the need for an augmentation source for water depletions caused to nearby wells. The design process required extensive groundwater modeling along with permitting through the State Engineers Office to prove no injury from the project to nearby well owners.

Great effort was made during the design to avoid creating traditional "bathtub" detention ponds. The team created multipurpose facilities for flood mitigation, wildlife habitat, and public trails. Ponds were designed with undulating slopes and floors with low-flow channels that appear natural. The majority of residents who travel through the ponds via the trails do not realize this "open space" will also provide more than 200 acre-feet of flood storage.

Enhancing the Community

Because Fort Collins has been recognized by many national publications as a great place to live, the design team had a very high standard to reach to keep and maintain the public trust. Specific innovative technologies were developed and implemented to accomplish the goals of the project while meeting community standards.

For example, the final outfall from the 102-inch storm sewer discharges 600 cubic feet per second during a 100-year storm. The volume and velocity of water requires substantial energy dissipation so a large scour hole is not created in the pond. The team designed a round version of the classic Bureau of Reclamation Type 10 hanging baffle structure, which achieved the same hydraulic function for energy dissipation but dramatically changed the look of the structure. Artevia colored Agilia concrete was used with a custom hand-carved form liner to create art on the hydraulic structure – enabling the use of the Art in Public Places funding that had been set aside for stormwater projects.

Providing for Education and Recreation

The landscape within the CIPO project maximizes access to educational opportunities with the inclusion of two accessible boardwalk structures suitable for large group interaction with wetlands. A soft surface loop trail encourages recreation and educational exploration around and through the stormwater basins. The trailhead includes an educational kiosk highlighting facts about the project. With two local schools within a half-mile of the natural area, the site provides ongoing educational opportunities to children as part of the City's watershed education program.

Judging Criteria 2: Enhancement of Surrounding Environment

Flooding in the area stemmed from insufficient detention and storm sewer inlets and pipes that were undersized for the storm flows in the increasingly urbanized area. This meant storm flows were ending up in the three area irrigation ditches, which overflowed because they were not designed or meant to handle the storm flows. Such urban flooding posed potential damage to the environment from water pollution, sewer backups, mold, and solid waste materials from damaged buildings.

Thinking Outside the "Box"

The design team developed alternative solutions to reduce costs, improve habitat, and simplify construction. The original master plan design called for building vertical concrete walls on both sides of the ditches and a secondary 8.5-foot-wide by 3.5-foot-tall box culvert along the west side of the ditches for irrigation flows. The chosen alternative broke outside the proverbial "box," instead intercepting storm flows before they enter the ditches and conveying them south via a 102-inch storm sewer through a series of five detention/water quality ponds. The design included redirecting the outfall for an existing pond to further reduce storm flows in the adjacent ditches.

The project also provided water quality treatment from urban runoff for 220 acres of urban areas. This was accomplished through construction of five water quality extended detention ponds within the project.

Construction and Revegetation

The project team prepared a Storm Water Management Plan (SWMP) and managed a Colorado Department of Public Health & Environment state-issued Stormwater Discharges Associated with Construction Activity permit throughout the construction and revegetation phases. The total disturbance was 45.3 acres, including City streets and all five detention ponds. By carefully planning each work order, the construction was phased, and areas were seeded and re-established immediately after the work was completed. A cover crop was used to provide quick vegetation, while the permanent seeding germinated and filled in to take over the cover crop. Temporary irrigation, weed control, and mowing operations ensured that the ponds were restored almost completely in their first season of growth. Temporary mulch was applied when portions of the project were dormant during winter months, which greatly reduced dust migration and minimized erosion. Native shrubs and trees were introduced to each new detention pond, and wildlife – including geese and other fowl, fox, deer, raccoons, and coyotes – quickly returned to the area.

Enhancing the Natural Habitat

The Natural Resources Department's goal for the project was to preserve and enhance wildlife habitat. The landscape architecture firm BHA was retained early in the design process to help accomplish the goal of the Natural Resources Department while maintaining the integrity of the engineered stormwater utility design. The landform was sculpted to mimic the natural environment with varying slopes, undulations in the basin bottom, serpentine water ways, and careful consideration for views of structures and locations of existing fox dens and trees. Native plant species were selected for specific project area conditions – e.g., numerous microclimates due to varying sun exposure, elevation with respect to groundwater, and expected stormwater effects. This project was designed to require little maintenance and no supplemental irrigation after plant establishment. Trees of varying sizes were used to increase diversity of shape and perceived age.

Judging Criteria 3: Incorporating Unique or Innovative Solutions

Alternative Product Delivery System

The CIPO project was designed and constructed using the City of Fort Collins Alternative Product Delivery System (APDS). This process uses the knowledge and experience of the owner (City of Fort Collins), the engineers (Ayres Associates and Anderson Consulting Engineers), and the contractor (Garney Construction) from conceptual design through construction as a design team. Advantages of APDS include the active and vital roles of the contractor and owner during design, better design quality, best value in materials and equipment selection, shortened design and construction schedule, more accurate cost estimating, and reduction of risk.

Slide Rail System

During the design phase, seven tunneling scenarios were developed to avoid 32-foot-deep excavations adjacent to condominiums and homes. Extensive soils investigations determined that a micro-tunnel would be the safest approach to ensure a successful tunnel. However, the tunneling approach was cost prohibitive, and the contractor chose to dig test pits to determine if the 102-inch pipe could be installed by open cut methods.

Because of the depths of the excavations and the sticky nature of the semi fluid sandy clays at these excavation depths, a slide rail system was proposed for the first 1,300 linear feet of pipe installation in 24- to 32-foot depths. The owner and the contractor visited an active project in Alabama to witness a slide rail system in use and determined that it would work for the CIPO project. A cost estimate was prepared for open-cutting the 102-inch pipe with a slide rail system, and it demonstrated that $2 million could be saved over a very risky, open-faced tunnel, and approximately $4 million could be saved over a less risky micro-tunnel. Although the slide rail system was slower than conventional trench box systems, it provided a safe, shored excavation, and it was compatible with the sticky clays that were encountered.

Increased Stormwater Storage

In the larger three of the five ponds constructed, underdrain systems were designed and constructed to increase storage potential and eliminate the loss of groundwater/water table due to evaporation. Doing so eliminated the need for an augmentation source for water depletions caused to nearby wells. The design process required extensive groundwater modeling along with permitting through the State Engineers Office to prove no injury from the project to nearby well owners.

Perimeter Drain

Working as a team, the engineers, contractors, and City staff came up with a better solution to the problem of high groundwater in an area that required 250,000 cubic yards of excavation. That solution incorporated a unique perimeter drain for dewatering before excavation and hauling. That solution alone saved more than $2 million.

Redesigned Hydraulic Structure

At the final outfall from the 102-inch storm sewer, 600 cubic feet per second will be discharged during a 100-year storm. The volume and velocity of water requires substantial energy dissipation so that a large scour hole is not created in the pond. A classic Bureau of Reclamation Type 10 hanging baffle structure was originally contemplated for this purpose. After lengthy discussion, the project team decided to design a round version of the same structure, which achieved the same hydraulic

function for energy dissipation but dramatically changed the look of the structure from the public's perspective.

Art in Public Places

Artevia-colored Agilia concrete with a custom hand-carved form liner was incorporated into the hanging baffle structure's design, which created art on the hydraulic structure to take advantage of the Art in Public Places funding that had been set aside for stormwater projects. Whereas most hydraulic structures such as wingwalls, headwalls, and energy dissipation structures are traditionally considered an eyesore, those for the CIPO project are viewed as works of art, with cattails and watermarks carved from liner impressions and buff-colored concrete. Corten handrail was used throughout the project to provide a maintenance-free system that has a rustic, less obtrusive appeal.

Landscape Design

The landscape design incorporated a number of unusual elements that are unique to habitat establishment, wetlands, and water quality. The landform was sculpted to mimic the natural environment with varying slopes. Native plant species were selected for specific project area conditions – e.g., numerous microclimates due to varying sun exposure, elevation with respect to groundwater, and expected stormwater effects. This project was designed to require little maintenance and no supplemental irrigation after plant establishment. Trees of varying sizes were used to increase diversity of shape and perceived age. Unlike an urban park where a well-maintained look is desired, the CIPO project was intended to look as natural as possible as soon as possible. Before the project, the site was relatively flat with minimally diverse plant species.

Judging Criteria 4: Multi-objective Management of Project Goal

The City of Fort Collins is very familiar with the Multi-Objective Management (M-O-M) process and uses it in all flood mitigation design projects. The CIPO project provides an excellent example of how the City incorporates the six basic guidelines of the M-O-M approach.

Keep Your Effort Locally Based

From start to finish, this flood mitigation project was locally based. Members of the design and construction team are from the Fort Collins area. Recognizing the need to accommodate local residents and commercial concerns, team members all contributed to an extensive public outreach effort to explain the challenges and goals of the project. Through newsletters, a web page, open houses, and daily face-to-face communication and coordination with the public, the design/construction team earned solid support for a highly visible and politically sensitive project.

Understand Your Flood Problem and Its Relationship to the Watershed

The City has developed Watershed Master Plans for every basin within the City's growth management area. Some of these watersheds are Federal Emergency Management Agency (FEMA) regulated basins, and some are not, but all have detailed master plans, and the existing 100-year floodplain has been defined. The master plans provide a detailed look at the existing flood risk in each basin. The CIPO project is within the Canal Importation Basin, which is a non-FEMA regulated basin. However, the Canal Importation Basin drains into the Spring Creek Basin, which is a FEMA regulated basin with a high risk of structure flooding.

The primary goal of this project was to reduce the risk of flooding. However, the design/construction team viewed the flood problem within its relationship to the watershed, which affected the analysis of alternative solutions. The final design resulted in a system that substantially reduces the risk of flooding but also improves water quality within the watershed.

Think Broadly about Possible Solutions to Reduce Flood Losses

The design for the CIPO project went through an extensive alternatives analysis process that started with the recommended solution from the master plan. The goals of the CIPO project matched those of the master plan, but the solution for the flooding was quite different. The innovative solution, resulting in far more benefits, was a combined effort of two engineering firms, the general contractor, and City staff all focusing on finding the optimal solution that provided maximum benefits.

The team engaged in a year-long alternative analysis phase to investigate many potential solutions to reduce costs, improve habitat, and simplify construction. The final design was a combination of innovations that provides benefits far beyond the primary goal of providing flood mitigation.

Coordinate Flood Loss Reduction with Other Community Needs, Plans, and Activities

The incorporation of an active park, open space, and water quality treatment within the detention ponds constructed with the CIPO project is an example of meeting other needs of the community while providing much-needed flood protection. One of the detention ponds features a boardwalk where students can view wetland species and vegetation up close without damaging the environment.

The project also re-established a riparian stream corridor through the detention ponds to improve habitat and water quality for a tributary to Spring Creek.

Coordination with the Art in Public Places program allowed portions of the project to be enhanced with aesthetic touches that represent the natural landscape in this region. Thoughtful landscaping provides welcome, open, natural space in the City. The detention ponds provide more than 200 acre-feet of flood storage, but the majority of the residents using the trails around the ponds will see a welcoming, natural landscape instead of the typical engineered project.

The project also benefits other entities within the City. The CIPO project is directly upstream from the Colorado State University campus. The University is one of the major beneficiaries of the reduced and redirected flows brought about by the CIPO project. In 1997, the campus suffered approximately $150 million in flood damages. The construction of the CIPO project reduces the inflows to the University campus during a 100-year storm event by almost two-thirds.

Obtain Expert Advice and Assistance

The CIPO project was designed and constructed using the City of Fort Collins Alternative Product Delivery System (APDS). The process uses the knowledge and experience of the owner (City of Fort Collins), the engineers (Ayres Associates and Anderson Consulting Engineers), and the contractor (Garney Construction) from conceptual design through construction as a design team. Advantages of APDS include the active and vital roles of the contractor and owner during design, better design quality, best value in materials and equipment selection, shortened design and construction schedule, more accurate cost estimating, and reduction of risk.

Build a Partnership by Developing a Plan

The team began by examining existing master plans and then dedicated a year to investigating various alternative solutions to the flooding problem. Working together through four years of planning, design, and construction, team members developed a solid relationship, which facilitated a design that provides the community with much more than flood control.

One of the strengths of this project is that members of the public also became “partners.” This was a highly visible and controversial project. Through planning and public outreach, the design team earned solid public support for the project. Team members provided extensive public outreach to explain project challenges and goals and by doing so earned solid public support for the improvements.

Judging Criteria 5: Solution, Budget, and Time Schedule Goals

The City of Fort Collins had incremental funding for the project, starting with $700,000 for 2006 to initiate the design and $5 million per year for four-successive years to complete the design and perform the construction. Balancing the inflow of funds with the amount of construction to be performed each year was a major challenge. Work orders were created and negotiated to accomplish large scopes of the project in a logical manner. In all, 17 work orders were developed and used to complete the project. These were created to relocate utilities, excavate the ponds, install interconnecting piping and structures, seed the ponds, and install temporary irrigation and native landscaping. Several other work orders were used for the installation of the 102-, 96-, 84-, and 78-inch concrete pipe stormwater conduits and storm sewer inlets. The project team prepared work orders for constructing outdoor classrooms and boardwalks, a natural areas parking lot with pedestrian trails, and a vault toilet and a kiosk, as well as to provide mowing and weed control as the site matured.

The goal was to design and construct the $21.5 million project in approximately five years. However, funding for the project changed with the economic collapse in

2008, and only $3 million per year became available for construction, which caused a year lapse in the storm sewer construction. Funds for 2010 and 2011 were pooled to complete the majority of the project in 2011, and all but the landscaping of the final pond remains. In sum, the project was driven by funding rather than schedule. However, three arterial road crossings had extremely tight schedules, and all three crossings were completed in advance of the scheduled re-openings.

During the early stages of design, the team created a project schedule that incorporated the design tasks of each of the two engineering firms (Ayres Associates and Anderson Consulting Engineers). Then a detailed construction schedule was developed for design and construction tasks. Schedule constraints included the irrigation season, which defined when the ditch crossings could be made; school-in-session constraints, which dictated when three arterial roads could be closed for the storm sewer installation; the annual bird nesting season, which controlled tree removal activities; and fox den exclusion activities, necessary for the pond construction. These constraints were all scheduled in advance of construction, requiring a major effort by the project team to build them into the construction schedule.

The construction schedule was updated daily to reflect the current level of design and the current state of construction and was the basis for the simplified schedule used on the City's website for the project. A SharePoint site hosted by the contractor facilitated the submittal process and was used for all project documentation, including contract drawings and specifications, submittals, photographs, daily reports, and anything that could be produced in digital format to serve as a complete record of the project.

Each work order was negotiated, and the construction was performed on a cost-plus basis, ultimately saving the City of Fort Collins $4 million. Performing the work on a cost-plus basis allowed for minor changes to be made on the fly, and it was the primary mechanism used to minimize and often eliminate risk.

Judging Criteria 6: Project Serves as a Model for other Communities

Alternative Product Delivery System (APDS)
The CIPO project was designed and constructed using the City of Fort Collins APDS. This process uses the knowledge and experience of the owner, the engineers, and the contractor from conceptual design through construction as a design team. The APDS system requires "checking your ego at the door" because ideas and solutions are thoroughly vetted by the entire team in an atmosphere of trust.

The numerous advantages of APDS include the active and vital roles of the contractor and owner during design, better design quality, best value in materials and equipment selection, shortened design and construction schedule, more accurate cost estimating, and reduction of risk. In fact, in the 20-year history that Fort Collins has used the APDS process, total change orders amount to a negative $4.7 million, with no claims or lawsuits.

This project proves the APDS design-build project delivery method is highly effective for large projects. Working together, the design team developed the most effective and efficient design possible while incorporating creative design and the best available construction techniques. Working in the APDS environment encourages creativity and flexibility in the design process and tremendous pride in the ultimate accomplishment. The approach of involving the contractor in key constructability decisions such as excavation in saturated soils and construction of large-diameter pipe at depths up to 30 feet is an approach that can be transferred to other projects.

An atmosphere of trust, teamwork, and commitment among the design-build team resulted in a project completed on time and under budget while meeting public expectations. The owner, engineers, and contractors were at the design table together from Day One and closed ranks through four years and four phases of construction. The project resulted in no claims, and change orders total a remarkable negative $3.9 million.

Transferrable Design Ideas

Other communities could consider:

- Intercepting and redirecting storm flows upstream of the flooding area.
- Designing detention ponds as multipurpose natural areas.
- Using artistically enhanced hydraulic structures.
- Incorporating a unique perimeter drain for dewatering an area with high groundwater before excavation and hauling – a solution that saved more than $2 million.

Public Relations

Extensive public outreach from the entire design-build team – which described the challenges and goals of the project – resulted in solid support for a highly visible and politically sensitive project. Efforts included newsletters, a web page, open houses, and daily face-to-face communication and coordination with the public.

One-Page Summary

The Canal Importation Ponds and Outfall (CIPO) project provides needed flood mitigation, water quality improvements, habitat improvements, stream restoration, and opportunities for outdoor wetland education activities for the community of Fort Collins, Colorado. The $21.5 million project's key accomplishment is flood mitigation for nearly 200 homes and several roadways in an area immediately upstream of Colorado State University in the heart of Fort Collins. Despite the size of the project – five regional storm ponds, 4,500 feet of large-diameter (78-to-102-inch) concrete pipe, and 250,000 cubic yards of excavation – the project earned solid public support.

This project achieved its most important goal of reliable flood protection, but designers took advantage of the opportunity to accomplish much more. The project re-established a riparian stream corridor through the detention ponds to improve habitat and water quality for this tributary to Spring Creek. The regional detention/water quality ponds were treated as opportunities to restore natural areas to the urban setting.

The project area wasn't originally designed with stormwater in mind; in fact, college students once kayaked down City streets after a 1997 flood. Flooding stemmed from insufficient detention and storm sewer inlets and pipes that were undersized for increased storm flows in the increasingly urbanized area. Stormwater pooled in three irrigation ditches, which overflowed because they were not capable of handling storm flows.

A citywide stormwater master plan developed in 2001 included a conceptual plan for mitigating flooding in the area. However, the master plan required building dual conduits in the backyards of people's homes – an impractical solution in terms of cost and impact to the residents.

Using its Alternative Product Delivery System (APDS), the City assembled a team in 2006 of two engineering consultants – Ayres Associates and Anderson Consulting Engineers – and general contractor Garney Construction to work in concert with the City. A key aspect of the APDS system is that the design team becomes the construction team, providing a seamless transition from design to construction because each team member understands how each decision is made along the way.

The team engaged in a year-long alternative analysis phase to investigate many potential solutions to reduce costs, improve habitat, and simplify construction. The original master plan design called for building vertical concrete walls on both sides of the ditches and a secondary box culvert along the west side of the ditches for irrigation flows. In contrast, the chosen alternative involved intercepting storm flows before they enter the ditches and conveying them south via a 102-inch storm sewer through a series of five detention/water quality ponds. The design included redirecting the outfall for an existing pond to further reduce storm flows in the adjacent ditches.

The design team implemented several innovative technologies to accomplish the goals of the project while maintaining public trust. For example, the team designed a round baffle structure, rather than the traditional rectangular-shaped structure, to slow the large volume of water at the final outfall so it would not create a large scour hole in the pond. This round design dramatically changed the look of the structure and made it more aesthetically appealing. It also incorporated a custom hand-carved form liner, which allowed the City to use Art in Public Places funding that had been set aside for stormwater projects.

Additionally, great effort was made during the design to avoid creating traditional "bathtub" detention ponds. Instead, the team designed multipurpose facilities for not only flood mitigation but also wildlife habitat and public trails.

An atmosphere of trust, teamwork, and commitment among the design-build team resulted in a project completed on time and under budget while meeting public expectations. The owner, engineers, and contractors were at the design table together from Day One and closed ranks through four years and four phases of construction. The project resulted in no claims, was finished on schedule, and was completed within the $21.5 million budget with total change orders a remarkable **negative** $3.9 million.