Paonia River Park Project
Final Report

August 30, 2013

Submitted By:

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WSCC

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Introduction

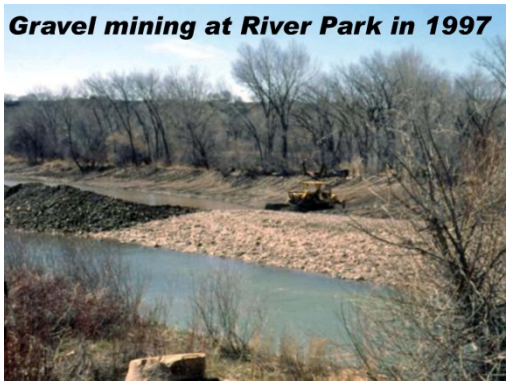
The Paonia River Park Restoration Project rehabilitated over 1,600 feet of river channel and restored approximately 8 acres of aquatic habitat within the floodplain of the North Fork of the Gunnison River at the Paonia River Park. The Paonia River Park was once an in-stream gravel pit and is currently the only public river access point along 30 miles of the North Fork of the Gunnison River.

This project was coordinated by the Western Slope Conservation Center, designed and implemented by Crane Associates, and made possible by habitat mitigation funds from the Bureau of Reclamation's Minnesota Ditch Project, the Colorado Water Conservation Board and the Delta Conservation District. The project offset habitat loss along the newly piped Minnesota Ditch near Paonia. In this way, it offers a model example of how habitat mitigation funds can be used locally, keeping both the improvements and funding within the community.

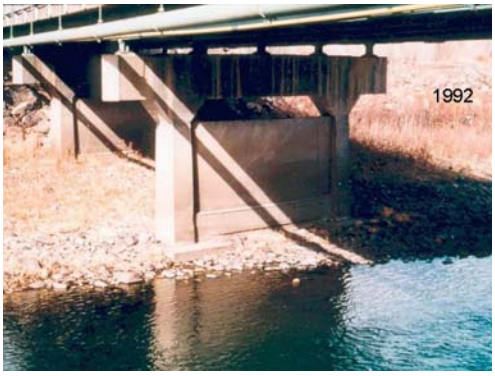
Project Background

The headwaters of the North Fork begin in the Gunnison National Forest at the confluence of Anthracite and Muddy Creeks and flows 33 miles southwest through the Towns of Paonia and Hotchkiss in Delta County before meeting the mainstem of the Gunnison River near the Black Canyon of the Gunnison National Park and the Gunnison Gorge National Conservation Area. The project site is located on the northern boundary of the Town of Paonia.

Throughout much of the 70's, 80's and 90's this 19-acre site was used as an in-stream gravel mine. The in-stream gravel mining contributed substantially to the destabilization of the channel and created extensive downcutting of the river bed both up and downstream of the actual mining boundaries. This excessive scouring resulted in the abandonment and relocation of several irrigation diversions, the lowering of the local groundwater table, accelerated bank erosion, and threatened the integrity of two bridge structures.



In 1997 the North Fork River Improvement Association (NFRIA) documented five vertical feet of channel downcutting in five years and called attention to an unsafe highway bridge abutment as a result of the scour. The local watershed group formed just a year earlier to develop local collaborative efforts to restore morphological integrity and riparian health to a battered 16-mile stretch of the river. Since 1996 the organization contributed to the restoration of a single-thread meandering channel along 6 miles of the river, the reconstruction of 8 irrigation diversions for fish migration and recreational boating, the removal of one dam and the relocation of 2 in-stream gravel mines. At the Paonia River Park site NFRIA negotiated with the gravel company for the donation of the 19-acre site as a community river park and worked to support the relocation of the gravel mining operation away from the river.



In 2006 NFRIA took ownership of the site with the intent of restoring riverine health and creating the first river park in the North Fork Valley where 95% of the land along the river is privately owned and river access is extremely limited. On hot summer days adults and children alike can be found swimming in a small pool in the river. A primitive boat ramp was constructed by local boating enthusiasts and the community raised money to fence the site, build a small trail and construct a parking lot with a beautiful entrance feature. However, the river was still in desperate need for restoration. The channel was badly braided and could not move sediment bedload through the system or adequately hold fish.

The high priority rehabilitation area mainly consisted of an approximate 1,500 foot reach of the river that was the primary gravel mining area. A large pit was excavated in the river and was never required to be reclaimed. That area had 4 channels running through it with no primary watercourse. Erosion rates were high and aquatic habitat was severely compromised. The design concept of the project was to rehabilitate the floodplain and construct a single-thread meandering channel that properly integrates the single-thread channel immediately above and below this area. The project was designed to balance the bedload transport capabilities of the channel and enhance the morphological integrity of the ecosystem.

This project was implemented by reconstructing one of the braided channels into the primary channel and securing logs and woody debris in the secondary channels. The secured debris slows the velocity of water overtopping the bankfull elevation of the floodplain and allows the river to deposit sediment and its natural seed base onto the floodplain. This floodplain rehabilitation project utilizes the natural riverine processes to sustainably revegetate the floodplain.

Rock structures and root wad revetments (bank stabilization structures) were installed along the outside bends of the primary channel to stabilize the riverbank. Similar structures were also employed at the head of the secondary channels but not constructed any higher than bankfull elevation. The design encourages overtopping of the floodplain during high runoff events. Willow cuttings and cottonwood tree transplants supplement the revetment structures and add native riparian vegetation to the exposed banks. Volunteers were utilized for installation of vegetative enhancements and the removal of invasive Russian Olive and Tamarisk species.

This project received a NWP 27 for Aquatic Habitat Restoration, Establishment, and Enhancement Activities from the Army Corps of Engineers on Nov. 13, 2012.

Project Implementation

Construction commenced on November 14th and continued through to December 7th, 2012. The project area consisted of approximately 3.52 acres of open water and 2.25 acres of wetlands. None of the construction impacted the existing wetlands that were delineated and mapped prior to construction. A new river channel was constructed along the north side of the project site. The gravel excavated from that site was used to fill 3 additional side channels and rehabilitate those areas into an active floodplain. The new channel was stabilized using large boulders, root wads, willow cuttings and transplanted cottonwood trees. Four rock vanes were constructed to reduce shear stress along outside banks.

Four boulder grade control structures were installed to maintain an average grade of 0.72% throughout the rehabilitated channel. This grade was obtained through a hydrologic model analysis performed by Tetra Tech in August, 2012 and determined to be an appropriate grade to move the existing cobble bedload through the system at bankfull flow regimes without increasing erosive downcutting of the channel bed.

The cross channel grade control structures also provide deep pools for fish survival during the low flow irrigation season in late summer. Additional pool eddies, log vanes, root wads and overhanging cover were constructed for fish retaining structures. The downstream confluence of two side channels was left open to create fish backwaters for spawning habitat and protection of young fry and fingerlings. A map of these structures can be found on Sheet 1 of 5 of the as-built drawings in the appendix of this report.

Three hundred bundles of cut willows were installed in the previous side channels to act as a live willow silt fence thereby catching debris, reducing overbank flow velocities and depositing sediment and its riparian seed base. Grade control logs were built into the side channels horizontally level to spread out overbank flows and prevent gully-washing. The grade control logs were secured by diagonally placed posts excavated into the floodplain and overhanging the horizontal grade beams.

Along the downstream end of the project additional grade control logs were installed to pool groundwater from springs and allow settling of sediment in previous side channels. Eight new wetland pools were constructed in the rehabilitated floodplain and ringed with cattails and bull rush. Additional willow cuttings and willow transplants were randomly planted throughout the floodplain to encourage further growth of riparian vegetation. Woody debris from previous flood flows were scattered throughout the newly bare ground and an upland grass seed mix was broadcast throughout the new active floodplain. The previous side channels and

rehabilitated areas did receive overbank flooding even though the runoff season of 2013 was well below average.

The property along the south of the river park is currently owned by United Companies of Grand Junction and is used as a concrete batch plant. In early January extreme cold created ice dams in Minnesota Creek and blocked the existing 60" culvert that flows north through the river park and into the North Fork. The resulting overtopping of the creek within the United Companies property flooded their gravel yard and broke through the gravel berm on the south property line of the river park. The rehabilitated floodplain performed as expected and the avulsion flow was safely diverted to the North Fork.

As a result of the flood a rock weir was installed at a low point in the gravel yard along the river park property line and additional log flow spreaders were installed. The 60" culvert was replaced by United Companies with a 30' wide bridge. This is anticipated to increase flow capacity, reduce ice dams and pass future flood flows.

Project Monitoring

Eight (8) permanent cross sections were established throughout the project. These cross sections have measured the pre-construction (9/2012), post-construction (2/2013) and post-runoff (7/2013) morphological conditions of the channel and floodplain. Photos were taken at each cross section in specific locations. Each cross section has photos taken at each endpoint looking toward the channel and photos looking at the center of the cross section from both upstream and downstream. Four of the eight cross sections also had midpoints that were used as endpoints for photos because some of the existing vegetation did not allow for a clear view all the way across the cross section and it is important to gage success at both the reconstructed side channels as well as the new primary channel. Additional photos were also taken at key revetment structures.

BEFORE RESTORATION 9/12 AFTER RESTORATION 12/12

Post-Construction Observations

An as-built survey following construction was performed on February 25, 2013 and a post-runoff survey was performed on July 17, 2013. All eight (8) cross sections that were established prior to construction were re-surveyed during both the February and July surveys. In addition, the location of four (4) rock weirs and six (6) root wad revetments were surveyed.

The average peak flow in mid-May was approximately 1,600 cfs. Bankfull flow is statistically about 2,500 cfs but overtopping throughout the floodplain was achieved and sediment deposition occurred as designed.

South side channel May 2013

South side channel August 2013

Photo points were taken on September 19, 2012 prior to construction, December 8, 2012 immediately following construction, May 28, 2013 during runoff at approximately 1,200 cfs and on August 19, 2013 after the initial establishment of new riparian vegetation. A survey of the success rate of planted willows was performed on August 25, 2013.

Results

Cross sections – (See Appendix for location and plots of each cross section)

3+00 – This cross section was located downstream of the project boundaries across the popular "swimming hole" at the confluence of Minnesota Creek. The purpose of this plot was to identify any changes in the pool due to the project. The horizontal dimensions of the pool remained primarily unchanged but the depth of the pool increased by close to 3 feet. It is speculated that the concentration of flow from one channel instead of three improved the scouring capability of the river at the pool.

5+80 – This cross section traverses the previous south side channel where it met the current main channel upstream of Minnesota Creek. The side channel was filled at the confluence and stabilized with large rock. A series of wetlands were developed in the side channel for aquatic and terrestrial habitat. Willows, bulrush and cattails were planted around the perimeter of the wetlands. Two piezometers were installed along this cross section to measure the depth of groundwater relative to the surface water of the river. The main channel at this location deposited a new gravel bar on the north side of the river and is forming a new point bar. The main low flow channel was narrowed substantially and the depth decreased by about one foot. The floodplain is thriving with new riparian vegetation and the revetments along the south side of the bank remained unchanged. It is expected that the new point bar will grow over time and generate new vegetation as well. This would be a good location for additional adaptive management to stabilize the point bar and create additional fish holding structures above the bar.

New gravel point bar with main channel on left

Looking upstream at new pool

8+04 – This cross section traverses the entire floodplain with an angle point near the north side designed to measure the lower third of the meander bend in the new channel. The cross section indicates no appreciable change in the south side channel but a substantial filling of the middle side channel from flood deposits. The floodplain through this section is growing rapidly. The primary channel on river right widened approximately 25 feet along the inside point bar naturally adjusting to the increased flow. All of the rock and root wad revetments are intact as installed but the rock weir on the left side of the channel needs to be extended to accommodate the widened channel.

11+28 – This cross section traverses the widest portion of the reconstructed floodplain and the new channel. There are no angle points across the cross section and it runs across the apex of the meander bend on river right. Several log flow inhibitors were installed along the section and worked well to deposit sediment and the natural riparian seed base. New riparian recruits are now establishing throughout both previous side channels. The primary channel is intact and the rock structures and bank revetments are stable and working as designed. The point bar on river left of the primary channel is also beginning to establish new vegetation. There is little change in the dimensions of the cross section between pre and post runoff. There are two other piezometers located along this cross section to measure groundwater depth relative to the surface water in the river.

Looking downstream across the primary channel

12+61 – This cross section traverses the upper floodplain and angles across the new primary channel at the top of the meander bend to the left. Prior to construction the main channel was on the south side of the river. The new alignment changed that to the north side. A substantial amount of river gravel was excavated from the north side and filled in the south side. As a result the cross section indicates over three feet of fill in the south channel. The new primary channel was located approximately twelve feet south of the previous low point to smooth out the meander bend and stabilize the outside bank with boulders. There was about a one foot scour along the south side of the channel on the point bar as a natural adjustment to increased flows. The thalweg remained as constructed. There was substantial deposition in many locations across the reconstructed floodplain and the log flow inhibitors worked well. Many new riparian recruits have established across the floodplain.

New riparian vegetation established

13+82 – This cross section traverses across the top of the previous south channel and then angles across the new north primary channel below the meander bend to the right. It also cuts across a previous side channel on the north that was filled in at the top but left open on the bottom for fish habitat. This section cuts across the open lower end of that previous side channel. On the south side (left) of the section there is approximately three feet of fill in what was once the primary channel. Large boulders and two large cottonwood root wads were installed to prevent avulsion at this channel but constructed low enough to allow for overtopping. The overtopping occurred at about 1,200 cfs. The revetments held perfectly and the overtopping provided new sediment that was deposited in several locations by log flow inhibitors and live willow silt fences. A rock weir constructed at this section also remained unchanged and created a nice pool upstream. There was little change in the pre and post runoff measurements at all locations. New riparian vegetation has established throughout the floodplain across this cross section. The backwater channel has also established new riparian vegetation.

New pool above rock weir

15+11 – This cross section is located above the previous south side channel and the new meander bend to the right. It also cuts across a new point bar and the previous side channel on the north side that was filled. This section shows no appreciable change from pre and post runoff. It only indicates the filling of the upper portion of the side channel and the removal of a past dyke. A rock cross vane was installed at this cross section and it remained unchanged from pre to post runoff. Vegetation is establishing along the upper reaches of the point bar.

Looking upstream at cross section

16+64 – This cross section was established at the upper end of the project. A rock weir was constructed just downstream of the section. This weir also remained unchanged between pre and post runoff. There was a small amount of gravel filled at the north side of the channel where the previous side channel had started. That fill material remained unchanged between pre and post runoff as well.

Wide channel above the project

Willow Planting Success Rate

Three hundred bundles of willows, each approximately 12" in diameter, were cut from nearby sources close to the river and installed throughout the reconstructed floodplain. They were used for different purposes. Some were planted along the riverbank of the new channel, some were planted along the bank of previous side channels, some were planted in single individual locations throughout the previous side channels and others were planted thick in trenches across the side channels in front of log flow inhibitors.

The ones planted in trenches across the side channels were primarily used as live willow silt fences. Their purpose was to filter out sediment and debris while allowing water to pass and slow flow velocities. These silt fences worked very well for their intended purpose but few of them established new vegetative starts. There are no definitive reasons for why most of these did not grow but possible reasons include too much water and too thick of a bundle. These silt fences were placed in locations of varying depth to groundwater with varying densities of sediment around the bundles but only about 20% of the willows in these trenches actually survived.

Debris and sediment captured & some growth

Sediment upstream, gravel downstream & no growth

The best success rate of the willows planted occurred along the new primary riverbank and along the previous side channel riverbanks. The success rate in these locations was 90%. Most areas along the previous side channels had good soil coverage but the areas along the riverbank had little soil. Nevertheless both locations had strong success rates.

Willows thriving along previous side channel

Willows along river doing well

The individual willow plantings come with a mixed review. Some did well where others did not survive at all. There did not seem to be any definitive reason for the varied success. Overall the success rate was measured at 59%.

Unsuccessful willows in gravel bed

Willows thriving in side channel

The overall success rate of all willows planted was 68%. More study will take place in subsequent years to help determine best management practices that work well in this particular environment.

Photo Points

The Paonia Ditch diversion is located approximately 1,200 feet upstream of the project. During the late irrigation season the ditch typically dries up the river below the diversion to maintain its senior water rights. Both the preconstruction and the post runoff photos were taken during the late summer when the ditch was drying up the river. All of the water in the river shown in the photos is a result of groundwater seeping back to the river channel. It is this reason that the project was designed to consolidate low flows and attempt to create aquatic habitat from groundwater sources. See Appendix for compared photo points and other additional photos.

Summary

The project was designed to reconstruct a floodplain from several braided channels and to consolidate river flows into a single meandering channel that will enhance both aquatic and terrestrial habitat. The project accomplished that. Vegetation throughout the project is growing rapidly with a standard diversity of cottonwoods and willows making up the predominance of the species. Approximately 1.5 acres of new wetlands have been developed and 6 new pools were constructed to hold fish during low flows.

There were six (6) tasks associated with this project. They are:

1. Monitoring – A comprehensive monitoring plan was put in place, implemented and documented in this report.
2. Design Plans and Permitting – Plans were prepared by Crane Associates and submitted to the Army Corps' for permitting. The permit was issued on Nov 13, 2012.
3. Equipment mobilization and demobilization – Completed on time and within budget.
4. Channel reconstruction - Completed on time and within budget.
5. Invasive Species Control – The Colorado Conservation Corps completed invasive species eradication prior to construction of the project
6. Bank Stabilization and revegetation - Completed on time and within budget.

If funding was to become available additional improvements could include:

- Construction of flow inhibitors across the new gravel point bar at cross section 5+80 to prevent future braiding;
- Additional rock at the lower two weirs where the channel widened by 25' to further consolidate low flows;
- An addition weir above the gravel point bar to enhance the pool there and maintain additional fish holding.

APPENDIX

Cross Section 16+64

Pre-construction September 20, 2012

Left Bank

Looking Upstream

Post-construction August 19, 2013

Left Bank

Looking Upstream

Cross Section 16+64

Pre-construction September 20, 2012

Looking Downstream

Right Bank

Post-construction August 19, 2013

Looking Downstream

Right Bank

Cross Section 15+11

Pre-construction September 20, 2012

Left Bank

Looking Upstream

Post-construction August 19, 2013

Left Bank

Looking Upstream

Cross Section 15+11

Pre-construction September 20, 2012

Looking Downstream

Right Bank

Post-construction August 19, 2013

Looking Downstream

Right Bank

Cross Section 13+82L

Pre-construction September 20, 2012

Left Bank

Looking Upstream

Post-construction August 19, 2013

Left Bank

Looking Upstream

Cross Section 13+82L

Pre-construction September 20, 2012

Looking Downstream

Right Bank

Post-construction August 19, 2013

Looking Downstream

Right Bank

Cross Section 13+82R

Pre-construction September 20, 2012

Left Bank

Looking Upstream

Post-construction August 19, 2013

Left Bank

Looking Upstream

Cross Section 13+82R

Pre-construction September 20, 2012

Looking Downstream

Right Bank

Post-construction August 19, 2013

Looking Downstream

Right Bank

Cross Section 12+61L

Pre-construction September 20, 2012

Left Bank

Looking Upstream

Post-construction August 19, 2013

Left Bank

Looking Upstream

Cross Section 12+61L

Pre-construction September 20, 2012

Looking Downstream

Right Bank

Post-construction August 19, 2013

Looking Downstream

Right Bank

Cross Section 12+61R

Pre-construction September 20, 2012

Left Bank

Looking Upstream

Post-construction August 19, 2013

Left Bank

Looking Upstream

Cross Section 12+61R

Pre-construction September 20, 2012

Looking Downstream

Right Bank

Post-construction August 19, 2013

Looking Downstream

Right Bank

Cross Section 11+28L

Pre-construction September 20, 2012

Left
Bank

Looking
Upstream

Post-construction August 19, 2013

Left
Bank

Looking
Upstream

Cross Section 11+28L

Pre-construction September 20, 2012

Looking Downstream

Right Bank

Post-construction August 19, 2013

Looking Downstream

Right Bank

Cross Section 11+28R

Pre-construction September 20, 2012

Left Bank

Looking Upstream

Post-construction August 19, 2013

Left Bank

Looking Upstream

Cross Section 11+28R

Pre-construction September 20, 2012

Looking Downstream

Right Bank

Post-construction August 19, 2013

Looking Downstream

Right Bank

Cross Section 8+04L

Pre-construction September 20, 2012

Left Bank

Looking Upstream

Post-construction August 19, 2013

Left Bank

Looking Upstream

Cross Section 8+04L

Pre-construction September 20, 2012

Looking Downstream

Right Bank

Post-construction August 19, 2013

Looking Downstream

Right Bank

Cross Section 8+04R

Pre-construction September 20, 2012

Left Bank

Looking Upstream

Post-construction August 19, 2013

Left Bank

Looking Upstream

Cross Section 8+04R

Pre-construction September 20, 2012

Looking Downstream

Right Bank

Post-construction August 19, 2013

Looking Downstream

Right Bank

Cross Section 5+80

Pre-construction September 20, 2012

Left Bank

Looking Upstream

Post-construction August 19, 2013

Left Bank

Looking Upstream

Cross Section 5+80

Pre-construction September 20, 2012

Looking Downstream

Right Bank

Post-construction August 19, 2013

Looking Downstream

Right Bank

Cross Section 3+00

Pre-construction September 20, 2012

Left Bank

Looking Upstream

Post-construction August 19, 2013

Left Bank

Looking Upstream

Cross Section 3+00

Pre-construction September 20, 2012

Looking Downstream

Right Bank

Post-construction August 19, 2013

Looking Downstream

Right Bank

Scale 1" = 100 ft

0 50 100 200

DELINEATED WETLANDS–2.25 ac.

PARK PROPERTY BOUNDARY

MONITORED CROSS SECTION

RECONSTRUCTED EDGE OF RIVER

WEIR

DESIGNED CHANNEL

ASBUILT CHANNEL

ROOTWAD

16+64

15+11

13+82

12+61

11+28

8+04

5+80

3+00

LARGE BOULDER

No.	Description	Date	Approved

Designed by: JEFF CRANE
Dwn by: JPC
Ckd by:
Reviewed by:
Submitted by:

Date: Feb. 2013
Design file no:
Drawing Code:
Rev:
File name:
Plot date:
Plot scale:

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NORTH FORK GUNNISON RIVER
PAONIA RIVER PARK
DELTA COUNTY, COLORADO
FLOODPLAIN and
AQUATIC RESTORATION
ASBUILT PLAN VIEW

Sheet reference number:

Sheet 1 of 5

UPDATE

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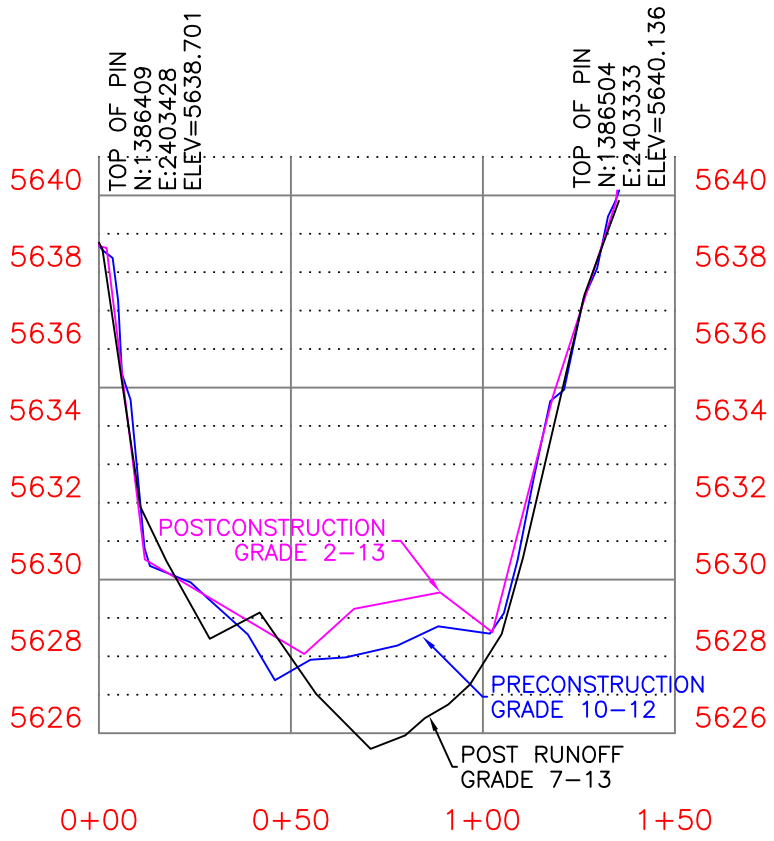
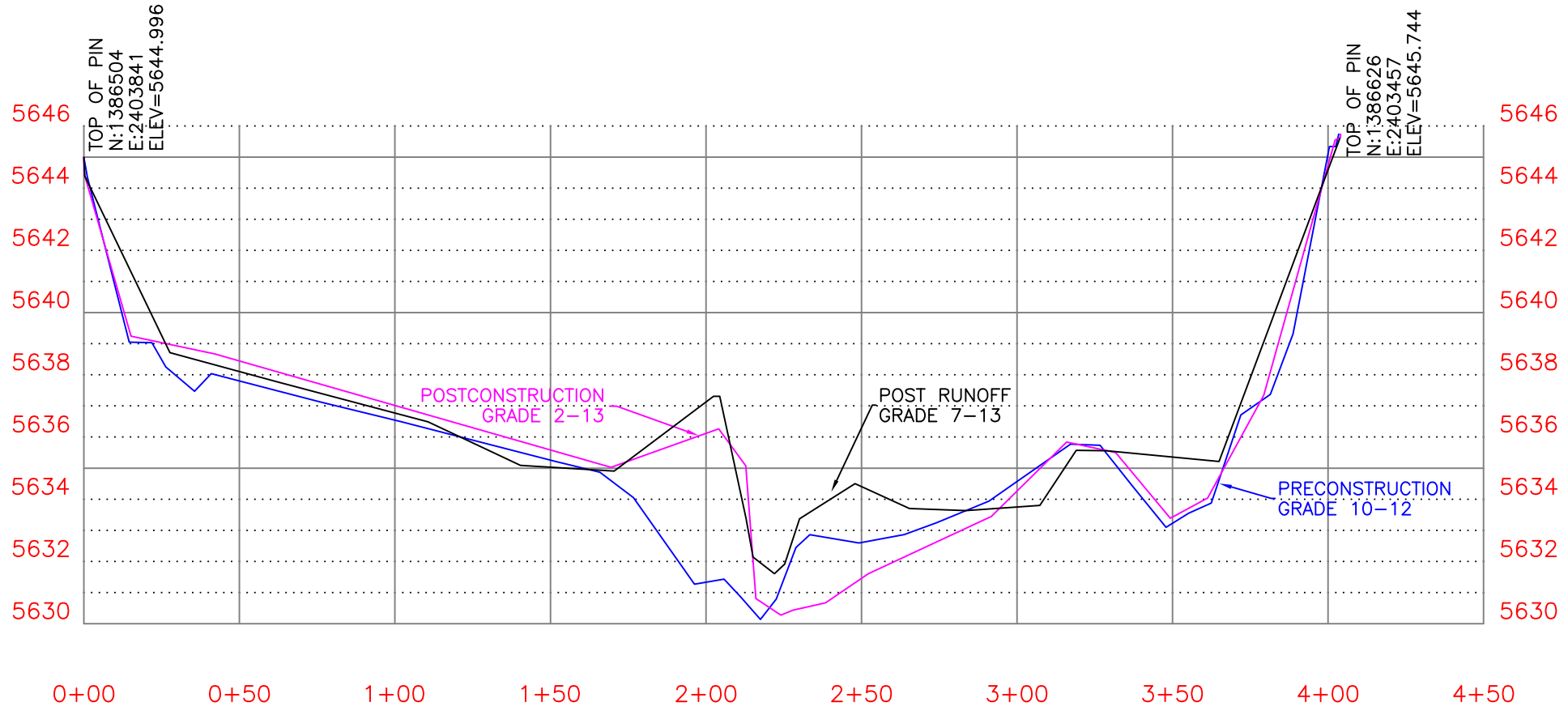


3+00



5+80

Horizontal scale 1" = 50 ft
Vertical scale 1" = 5 ft

CRANE ASSOCIATES

Description	Date	Approved

Date: Aug. 2011 | Rev:
Design file no:
Drawing Code:
File name:
Plot date:
Plot scale:

Designed by: JEFF CRANE | Dwn by: JPC | Ckd by: | Reviewed by: | Submitted by:

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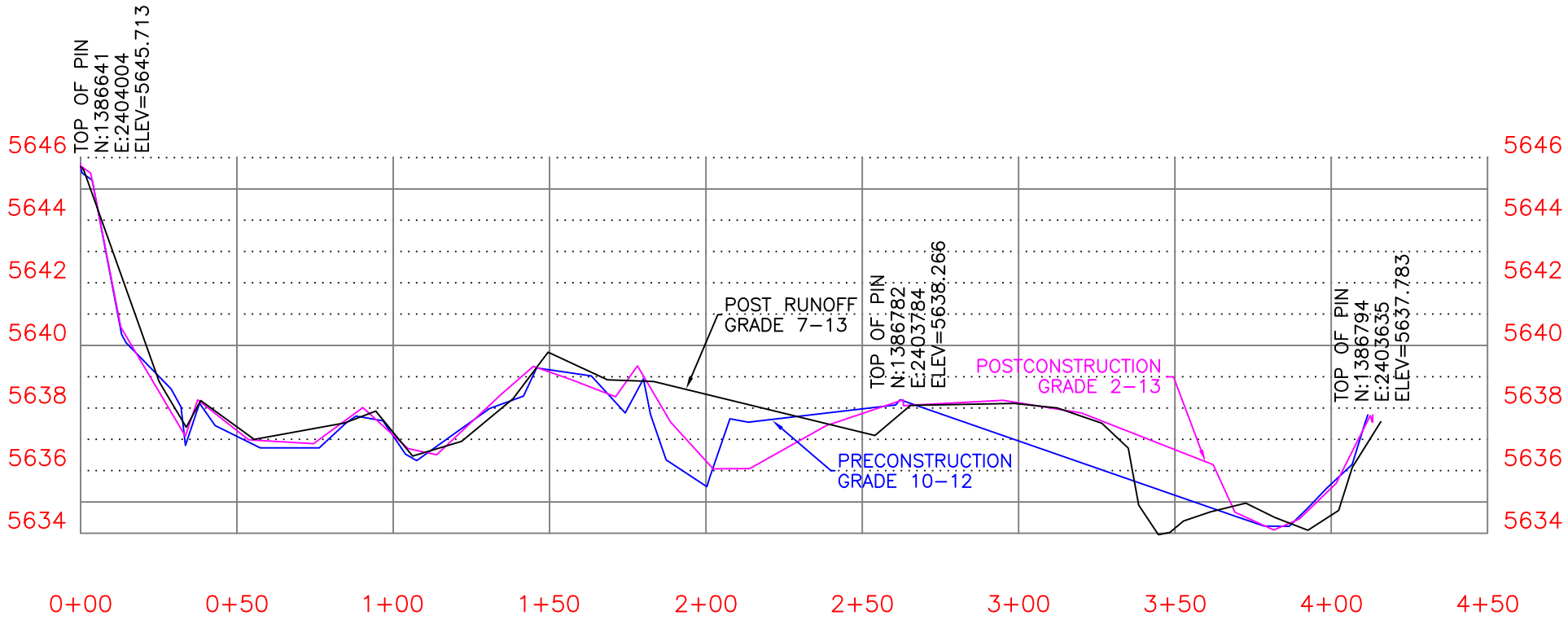
NORTH FORK GUNNISON RIVER
PAONIA RIVER PARK
DELTA COUNTY, COLORADO
FLOODPLAIN and
AQUATIC RESTORATION
CROSS SECTIONS

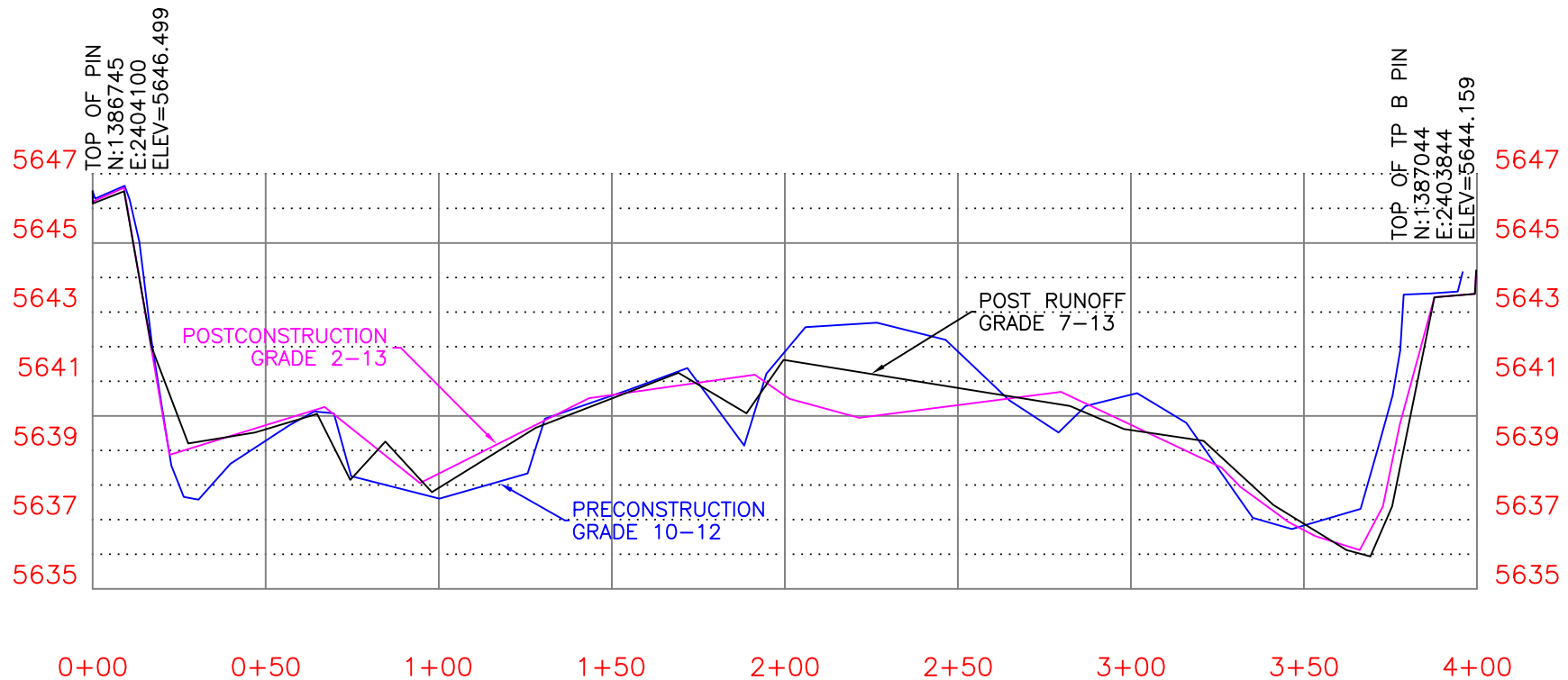
Sheet reference number:

Sheet 2 of 5

UPDATE



8+04



11+28

Horizontal scale 1" = 50 ft
Vertical scale 1" = 5 ft

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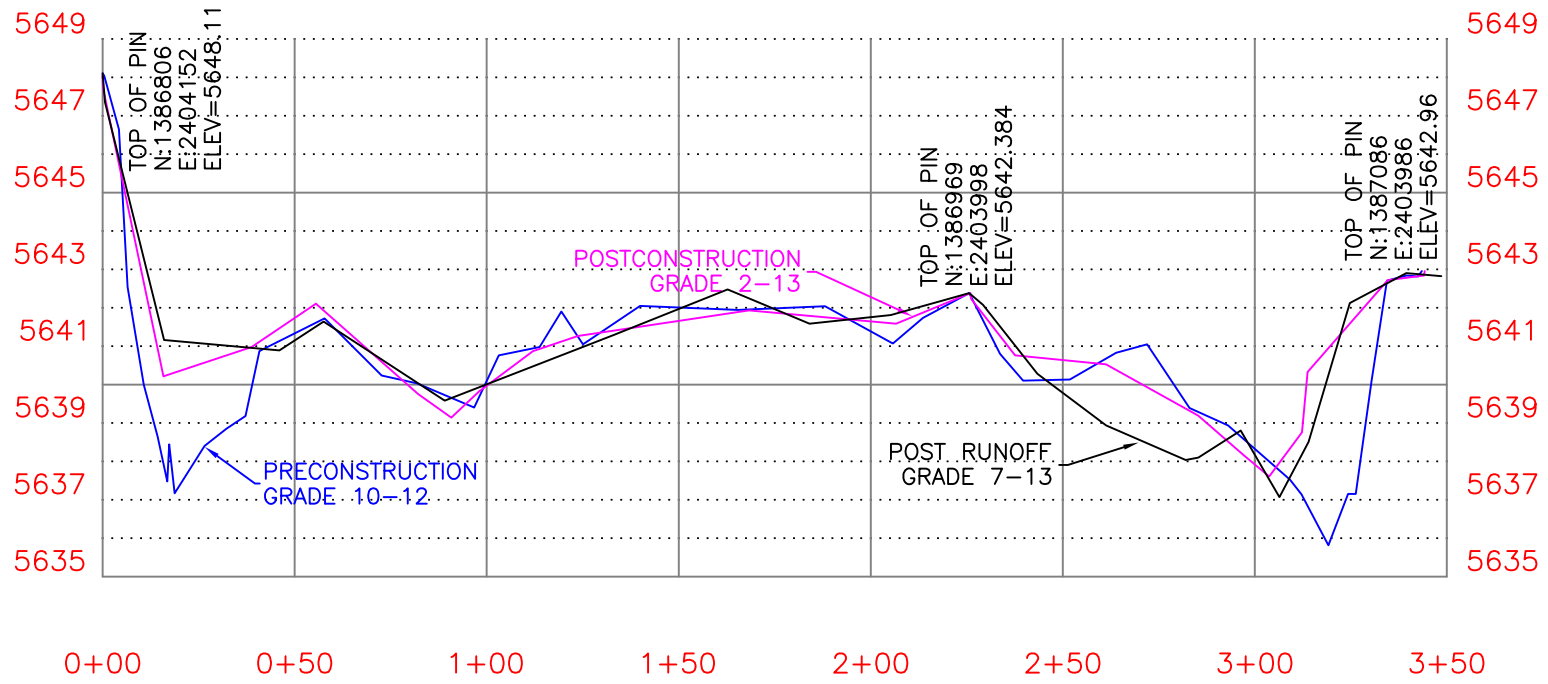
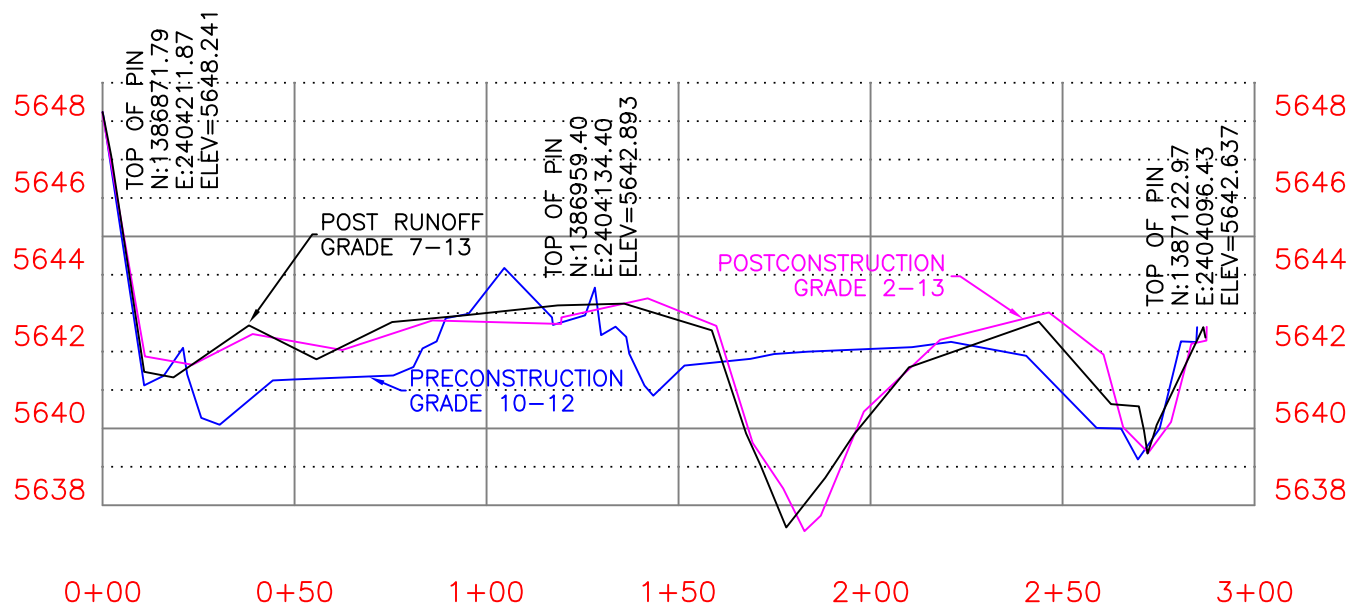
Sheet 3 of 5

UPDATE

DENSPEC



12+61



13+82

Horizontal scale 1" = 50 ft
Vertical scale 1" = 5 ft

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Ckd by:
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NORTH FORK GUNNISON RIVER
PAONIA RIVER PARK
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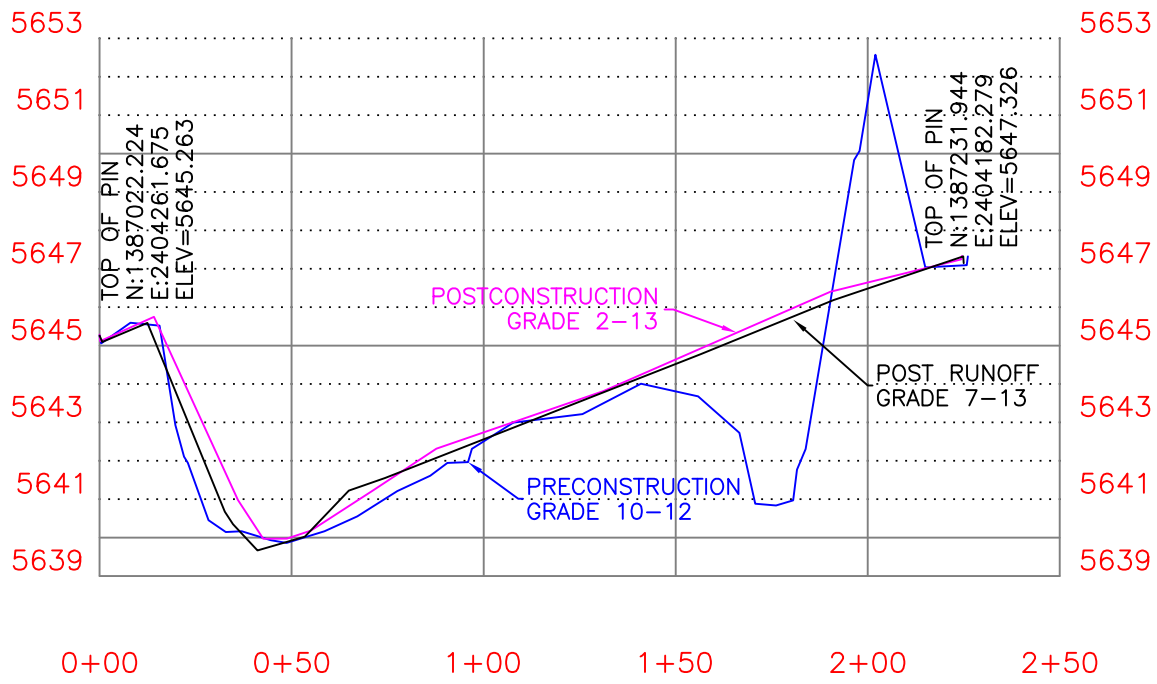
FLOODPLAIN and
AQUATIC RESTORATION
CROSS SECTIONS

Sheet reference number:

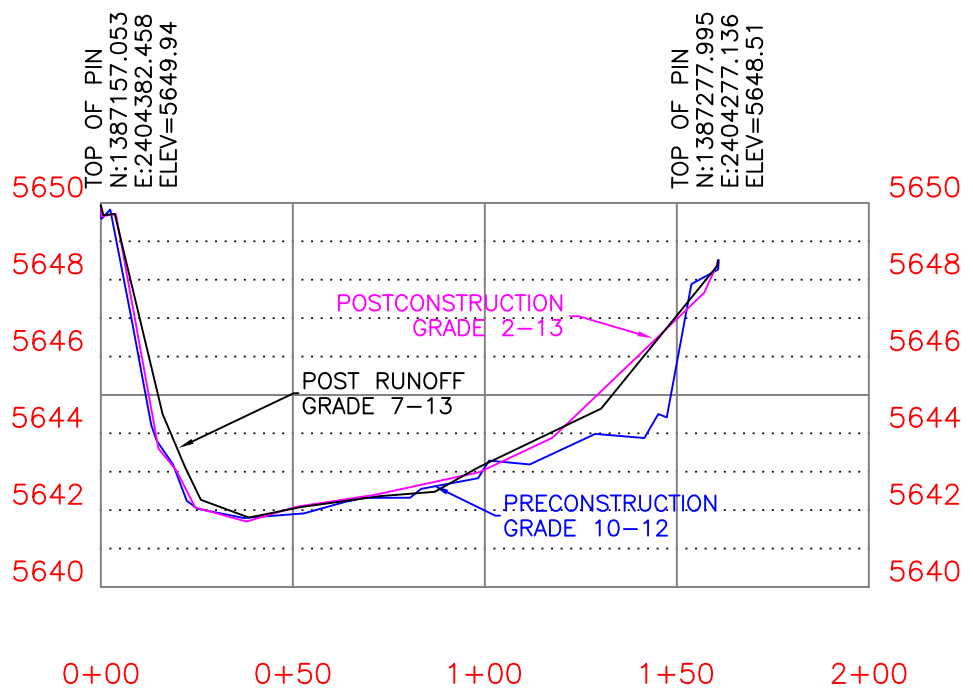
Sheet 4 of 5

UPDATE

8.02 C B A DONSPEC PLOT DATE: $$$$month$$$$ PLOT TIME: $$$$time$$$$



15+11



16+64

Horizontal scale 1" = 50 ft
Vertical scale 1" = 5 ft

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NORTH FORK GUNNISON RIVER
PAONIA RIVER PARK
DELTA COUNTY, COLORADO
FLOODPLAIN and
AQUATIC RESTORATION
CROSS SECTIONS

Sheet reference number:

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UPDATE

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