~~March 6, 2014~~

DRAFT - FINAL REPORT TO COME AFTER SPRING '14 WORK COMPLETE

Mr. Kiel Downing
Chief, Denver Regulatory Office
U.S. Army Corps of Engineers
9307 South Wadsworth Boulevard
Littleton, CO 80128-6901

RE: As-Built Report for the Upper South Boulder Creek Enhancement Project
Regional General Permit No. 12, Department of the Army File NWO-2013-1866-DEN

Dear Mr. Downing:

FlyWater, Inc. (Flywater) and Walsh Environmental Scientists and Engineers (Walsh) have completed construction on the Upper South Boulder Creek Enhancement Project as per the special conditions listed for Department of the Army File NWO-2013-1866-DEN. On behalf of the permit holder, USFS Boulder Ranger District, FlyWater and Walsh are pleased to submit this As-Built Report, which will also serve as the project's 2013 Annual Report.

CONSTRUCTION

The Upper South Boulder Creek Enhancement Project focused on improving aquatic habitat along two reaches of Upper South Boulder Creek downstream of the Moffat Tunnel near Rollinsville, Colorado. The upstream reach is the Moffat Reach. Measuring approximately 4,400 linear feet, the upstream extent of this reach is located about 300 feet downstream of the tunnel release to the creek. The Jumbo Reach is the downstream reach. This reach is located roughly 5 miles downstream of the Moffat Reach at the Jumbo Mountain Picnic Area, and measures approximately 2,800 linear feet. Both reaches receive intermittent augmented flows as a result of water delivery through the Moffat Tunnel. Delivered flows create an unnatural hydrograph with unusually high flows for the creek's position in the watershed, and pose a challenge to fish survival.

Habitat improvements were constructed at thirteen locations within the Moffat Reach (M1, M1.1- M12), and at seven locations within the Jumbo Reach (J1-J5, J7-J8). Pool excavation, benthic reshaping, and construction of channel bars including rock roughness elements at various elevations was completed at all locations. These features establish deep water habitat, improve low flow meander patterns, and create fish refuges during high flows associated with tunnel releases. Willow clumps were transplanted at multiple locations within the Moffat Reach; and rootwads were placed at five locations (M5, M7, M8 and two between M8 and M9). Willow clumps were transplanted at multiple locations within the Jumbo Mountain Reach; and rootwads were placed at two locations (J5 and J8). These features provide additional boundary roughness to reduce velocities at high flows, as well as overhead cover. At and between all improvement areas, habitat rock was placed intermittently to produce velocity breaks, to increase channel roughness, and to provide instream cover.

Rock used at all locations within the Moffat and Jumbo Reaches was harvested from the talus hillslope above the downstream portion the Moffat Reach. Roughly 800 tons of rock was harvested from an area measuring approximately 0.6 acre. In addition to the harvested rock, about 600 to 700 tons of rock was repurposed from within the channel for construction of project features. Harvesting rock from the site reduced project costs and site traffic, and increased schedule efficiency. Areas impacted during the harvest were reclaimed, as well as construction access points to the creek in both the Moffat and Jumbo Reaches.

AS-BUILT SURVEY

In July, 2013 a pre-project assessment and survey was completed using a total station. Survey coordinates are relative to an arbitrary datum. An as-built construction survey was completed in November, 2013 using a GPS system and instream measurements relative to water surface and constructed channel bars. A total station was not used in the as-built survey due to anchor and shelf ice present at the site.

Local control points used in the pre-design assessment survey are depicted on sheets 1D, and 2B of the attached plan set. Survey was performed relative to an arbitrary datum and was not tied to any NGS (National Geodetic Survey) control benchmarks. The local control points are as follow:

Pt.	N	E	Z
TBM 1	2959310	1207128	9227.0
TBM 2	2985256	1210854	8681.8

The enclosed plan set includes the original permit application and construction drawings with the following information from as-built GPS measurements superimposed for each improvement area:

- Earth disturbance area (as-built excavation and fill areas)
- Placed habitat boulders (approximate)
- Survey reference points
- Photo point locations

In addition to the as-built plans, photos for each improvement area are presented in this report.

MONITORING

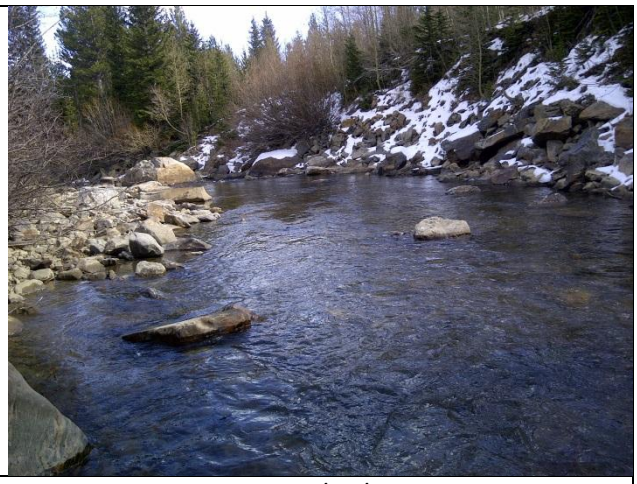
As noted in the Monitoring Plan section of the August 27, 2013 RGP 12 permit application, measurements will be taken annually for three years in order to assess project stability and success. Physical dimensions and a photographic record of each improvement location will be kept throughout monitoring. The as-built survey information and photographic record put forth in this report constitutes the baseline data for comparison over the next three years.

AS-BUILT PHOTOS

Photographs of each improvement area are presented below. The vantage point for each improvement area is shown on the plan set.

MOFFAT REACH

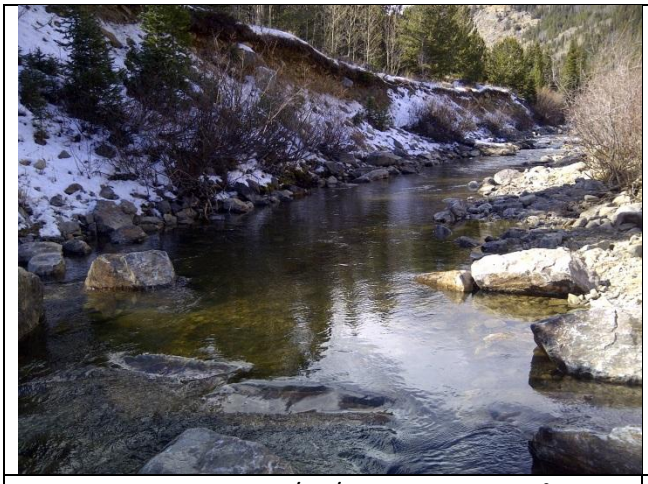
M1: View upstream 10/29/13. Bearing ~260°



M1: View downstream 10/29/13. Bearing ~100°

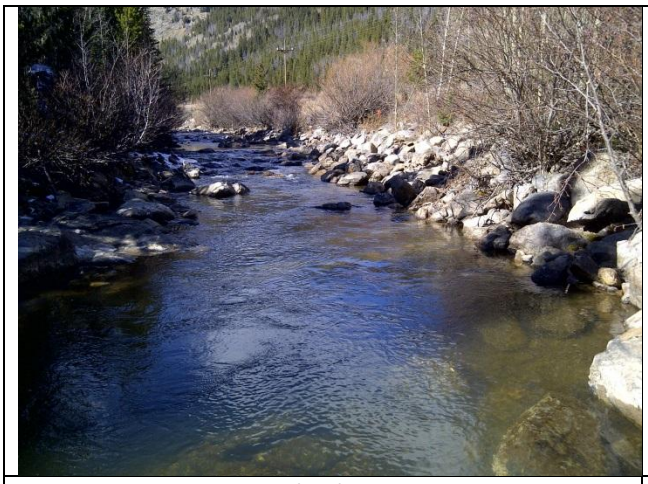
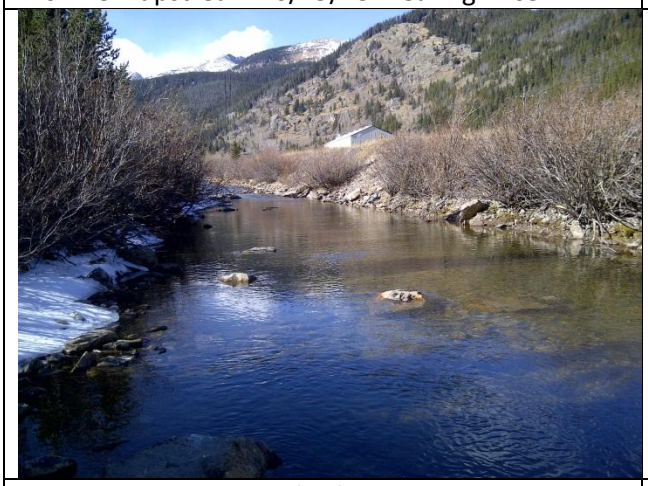
M1.1: View southeast 10/29/13. Bearing ~135°

	
M2: View upstream 10/29/13. Bearing ~270°	M2: View downstream 10/29/13. Bearing ~105°

	
M3: View upstream 10/29/13. Bearing ~285°	M3: View downstream 10/29/13. Bearing ~135°

	
M4: View upstream 10/29/13. Bearing ~290°	M4: View downstream 10/29/13. Bearing ~120°

	
M5: View upstream 10/29/13. Bearing ~300°	M5: View downstream 10/29/13. Bearing ~110°

	Photo not available
M6: View upstream 10/29/13. Bearing ~265°	M6: View downstream
	
M7: View upstream 10/29/13. Bearing ~270°	M7: View downstream 10/29/13. Bearing ~68°

M8: View upstream 10/29/13. Bearing ~240°

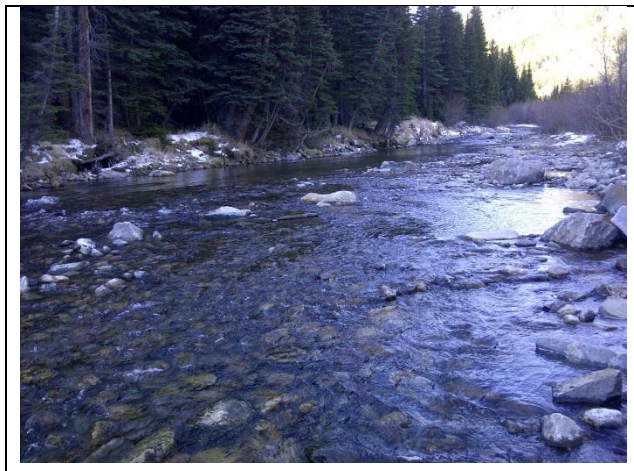
M8: View downstream 10/29/13. Bearing ~120°

Station 25+00 Rootwad 10/29/13. Bearing ~315°

Station 31+50 Rootwad 10/29/13. Bearing ~5°

Station 32+00 Rootwad 10/29/13. Bearing ~315°

NOTE: All rootwads include willow clump transplants



M9: View upstream 10/29/13. Bearing ~235°

M9: View downstream 10/29/13. Bearing ~95°

M10: View upstream 10/29/13. Bearing ~235°

M10: View downstream 10/29/13. Bearing ~85°

M11: View upstream 10/29/13. Bearing ~265°

M11: View downstream 10/29/13. Bearing ~90°

M12: View upstream 10/29/13. Bearing ~270°

M12: View downstream 10/29/13. Bearing ~85°

JUMBO REACH

J1: View upstream 11/07/13. Bearing ~270°

J1: View downstream 11/07/13. Bearing ~70°

J2: View upstream 11/07/13. Bearing ~270°

J2: View downstream 11/07/13. Bearing ~80°

J3: View upstream 11/07/13. Bearing ~270°

J3: View downstream 11/07/13. Bearing ~70°

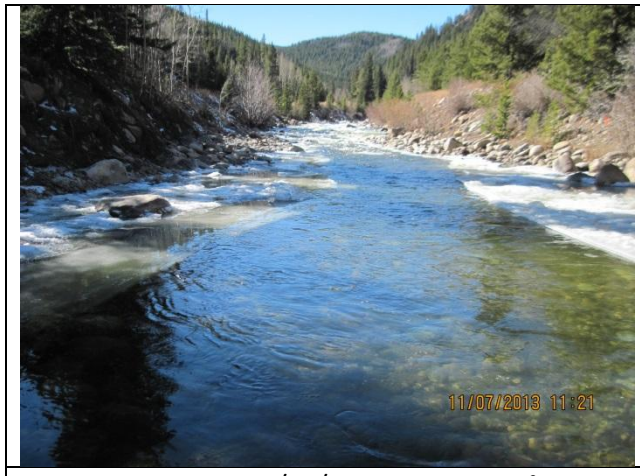
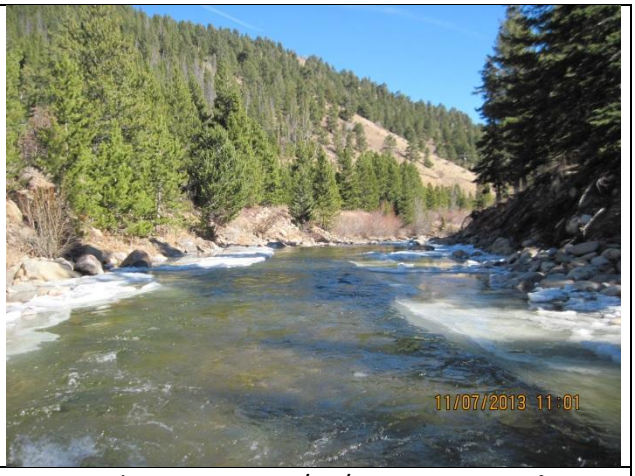
J4: View upstream 11/07/13. Bearing ~250°

J4: View downstream 11/07/13. Bearing ~45°

J5: View upstream 11/07/13. Bearing ~275°

J5: View downstream 11/07/13. Bearing ~85°

NOTE: J6 Not built due to bedrock. See Deviations from Permit section.

	
J7: View upstream 11/07/13. Bearing ~237°	J7: View downstream 11/07/13. Bearing ~43°

	
J8: View upstream 11/07/13. Bearing ~225°	J8: View downstream 11/07/13. Bearing ~45°

DEVIATIONS FROM PERMIT

The project was successfully completed, with all construction falling within the authorization of the Regional General Permit. The only deviations from the original plan set include slight shifts in location and extent of improvement areas, as well as the elimination of improvement area J6 due to the presence of bedrock in the channel, which precluded excavation of a pool. Minor adjustments to the location and extent of improvement areas were made to best incorporate the proposed improvements into the existing configuration and localized conditions of the creek. These variations fall within the criteria of the original permit, and the area of impact was within the 0.1 acres authorized by the original permit. Differences are shown on the enclosed plan set. A summary of differences is as follows:

Moffat Reach

M1: The pool at M1 was not excavated to the original design depth, as soft soils with high clay content were encountered. Native cobbles were placed to line the pool, which was excavated to a depth of approximately 1.5 feet. Pool M1 was constructed approximately 38 feet shorter than as designed resulting in a decrease in excavation area of about 410 square feet.

M1.1: This area was not included in the permit plan set. Accessing the boulder harvest site and construction of the haul road along the railroad tracks resulted in disturbance in this area. Improvement M1.1 was constructed in order to repair disturbances and reclaim this reach. The pool constructed here was very similar to other improvements, having a cut depth of approximately 2.5 feet. The cut area associated with M1.1 was approximately 2936 square feet and the associated fill was approximately 3750 square feet.

M2: Improvement M2 was built very close to the permitted design, the only difference being that most of the benthic grading occurred on river left.

M3: Improvement M3 was built with the pool starting approximately 46 feet downstream from where it was depicted in the permitted plans. Pool M3 was constructed approximately 19 feet shorter than as designed resulting in a decrease in excavation area of about 373 square feet.

M4: Improvement M4 was built very close to the permitted design, the only difference being that the cross-channel grade control structure depicted on the design drawings was not built. Randomly placed roughness rock was used instead.

M5: Improvement M5 was built very close to the permitted design.

M6: Improvement M6 was built very close to the permitted design.

M7: Improvement M7 was built with the pool starting approximately 27 feet downstream from where it was depicted in the permitted plans. Pool M7 was constructed approximately 35 feet shorter and somewhat wider than depicted in the permitted plans. These adjustments did not change the original excavation area.

M8: Improvement M8 was built with the pool starting approximately 73 feet downstream from where it was depicted in the permitted plans. Pool M8 was constructed approximately 83 feet shorter than as designed resulting in a decrease in excavation area of about 777 square feet.

M9: Improvement M9 was built fairly close to the permitted design, except that the pool was constructed further toward river right. Pool M9 was constructed approximately 38 feet shorter and slightly to be narrower than designed, resulting in a decrease in excavation area of about 1387 square feet.

M10: Improvement M10 was built with the pool starting approximately 22 feet downstream from where it was depicted in the permitted plans. This adjustment did not change the original excavation area.

M11: Improvement M11 was built fairly close to the permitted design except that the pool was constructed to be narrower at the upstream end and benthic grading was extended to cover both braids upstream of the island between areas M10 and M11.

M12: Improvement M12 was constructed approximately 90 feet downstream from where it was depicted due to its proximity to the Moffat tunnel outlet structure. The pool was constructed approximately 37 feet longer than depicted in the permitted design, resulting in an increased excavation area of about 657 square feet.

Jumbo Reach

J1: The pool at J1 was shifted downstream by approximately 37 feet.

J2: The pool at J2 was shifted upstream by approximately 62 feet and elongated for a total length of about 96 feet, resulting in an increased excavation area of about 465 square feet.

J3: The upstream extent of the pool at J3 was shifted downstream by approximately 35 feet to provide a longer transition between pools J3 and J4. The total length of this pool was decreased from about 75 feet to 50 feet. Benthic grading was extended on river left approximately 45 feet downstream, and a well-graded mixture of gravel, cobble and small boulders was placed along the toe of the slope near station 6+00 in order to provide bank protection and repair of an existing eroded area.

J4: Improvement J4 was built very close to the permitted design.

J5: The pool at J5 was shifted upstream by about 22 feet.

J6: The pool at J6 was not constructed due to the presence of bedrock in the channel at this location. Grading along the toe of the slope of river right was completed along approximately 150 feet to provide bank stabilization in this area, which is adjacent to the road and frequently accessed by the public.

J7: The pool at J7 was shifted upstream by approximately 200 feet. The length of the pool remained the same.

J8: The pool at J8 was shifted upstream by approximately 100 feet. Pool J8 was constructed approximately 60 feet shorter than as designed resulting in a decreased excavation area of about 2100 square feet.

CONCLUSION

The improvements along Upper South Boulder Creek were successfully constructed with some field changes, which were implemented to refine the overall function of the improvements and to ensure that total channel conveyance capacity was maintained along this reach bordering Union Pacific Railroad tracks. Performance of the project will be monitored over subsequent years in order to verify the project's success.

Kiel, we would like to thank you in advance for reviewing our Annual Report. If you have any questions or comments, please do not hesitate to contact us.

Sincerely,

FlyWater, Inc.

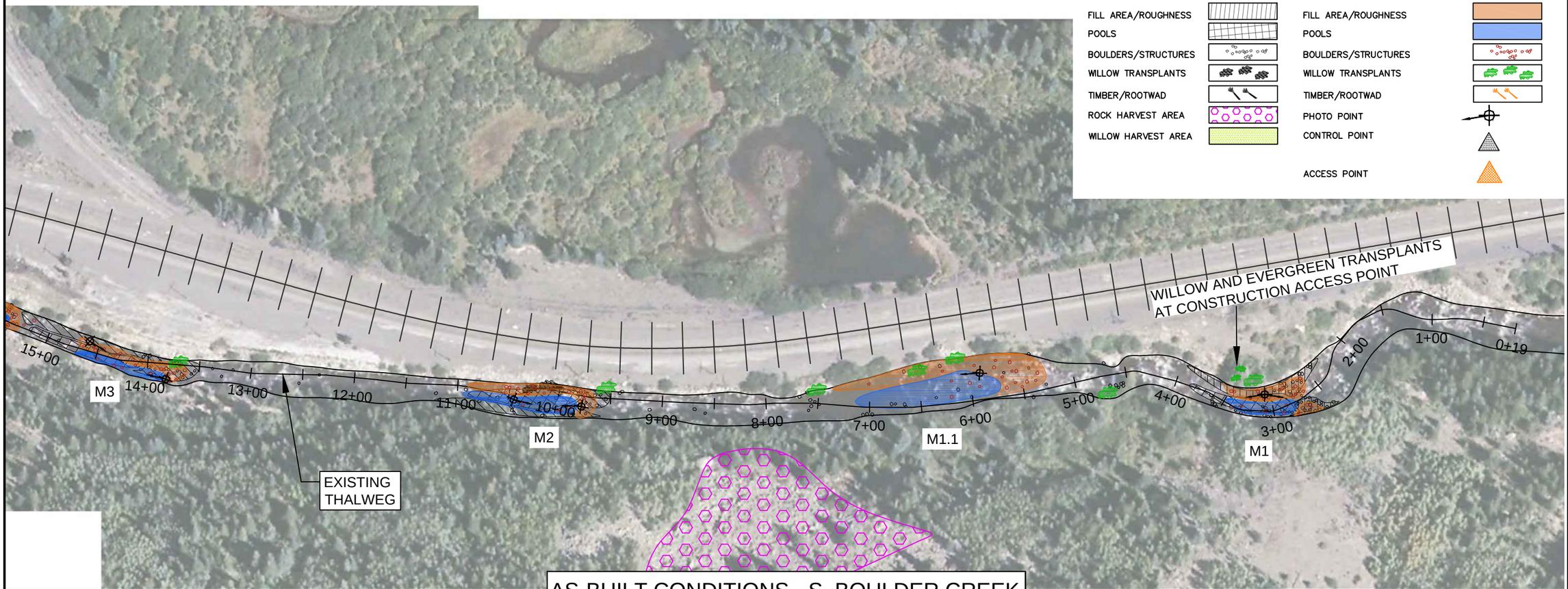
Corey Engen
President & Anglineer
corey@flywater.com
970-217-3182

Walsh Environmental

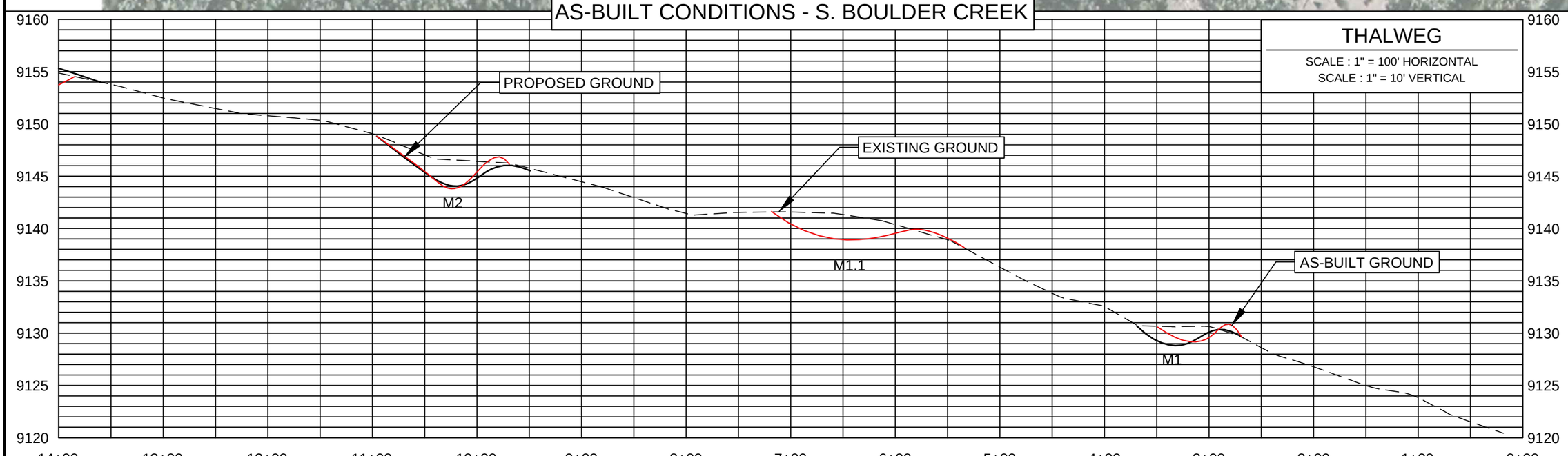
Blair Vajda
Water Resource Engineer
bvajda@walshenv.com
303-443-3282

LEGEND:

PROPOSED		AS-BUILT	
FILL AREA/ROUGHNESS		FILL AREA/ROUGHNESS	
POOLS		POOLS	
BOULDERS/STRUCTURES		BOULDERS/STRUCTURES	
WILLOW TRANSPLANTS		WILLOW TRANSPLANTS	
TIMBER/ROOTWAD		TIMBER/ROOTWAD	
ROCK HARVEST AREA		PHOTO POINT	
WILLOW HARVEST AREA		CONTROL POINT	
		ACCESS POINT	



AS-BUILT CONDITIONS - S. BOULDER CREEK



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AS-BUILT CONDITIONS
AQUATIC HABITAT IMPROVEMENT
PLAN & PROFILE

AS-BUILT IMPROVEMENTS
SITE 1 - MOFFAT TUNNEL
SOUTH BOULDER CREEK
GILPIN COUNTY, COLORADO

1A

PL. SCALE: 1"=100'
DATE: NOVEMBER 2013

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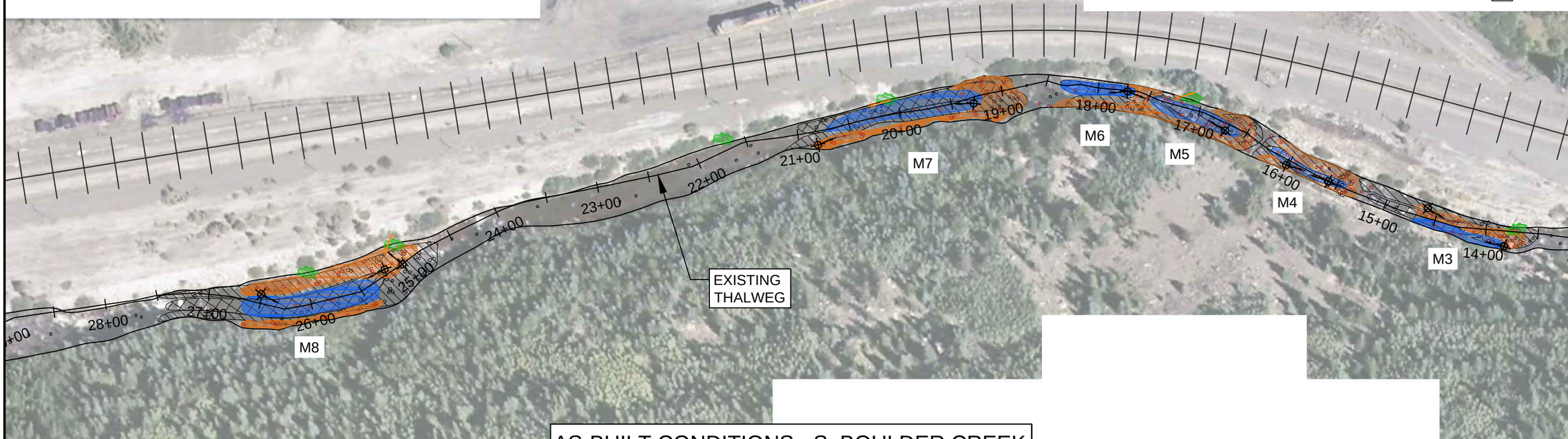
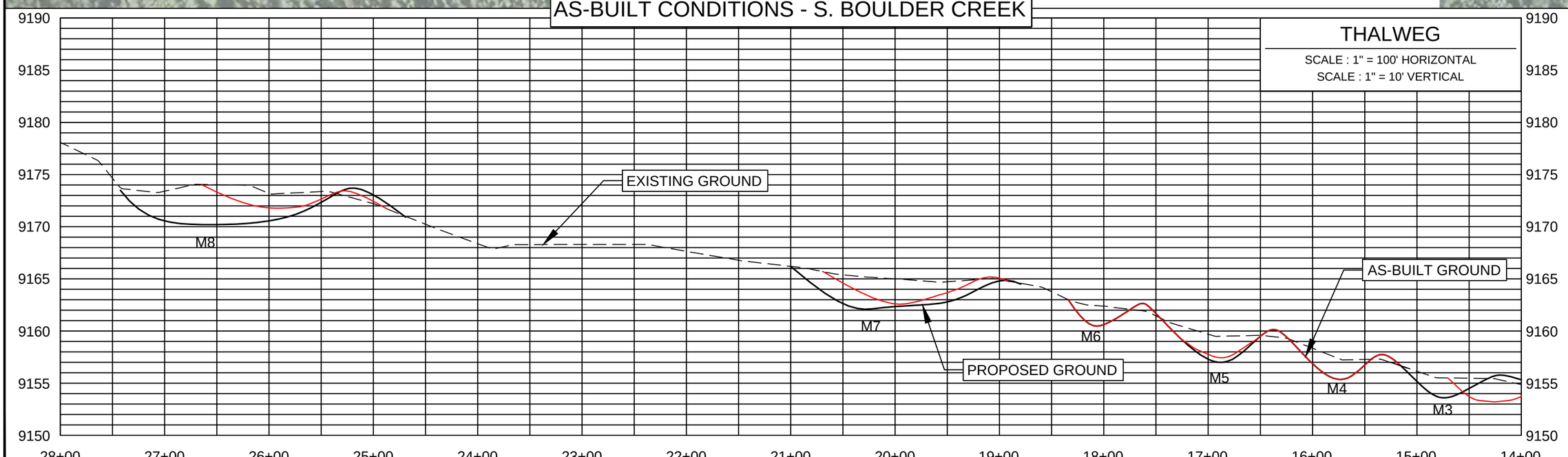
LEGEND:

PROPOSED		AS-BUILT	
FILL AREA/ROUGHNESS		FILL AREA/ROUGHNESS	
POOLS		POOLS	
BOULDERS/STRUCTURES		BOULDERS/STRUCTURES	
WILLOW TRANSPLANTS		WILLOW TRANSPLANTS	
TIMBER/ROOTWAD		TIMBER/ROOTWAD	
ROCK HARVEST AREA		PHOTO POINT	
WILLOW HARVEST AREA		CONTROL POINT	



AS-BUILT CONDITIONS - S. BOULDER CREEK



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GILPIN COUNTY, COLORADO

1B

PL. SCALE: 1"=100'
DATE: NOVEMBER 2013

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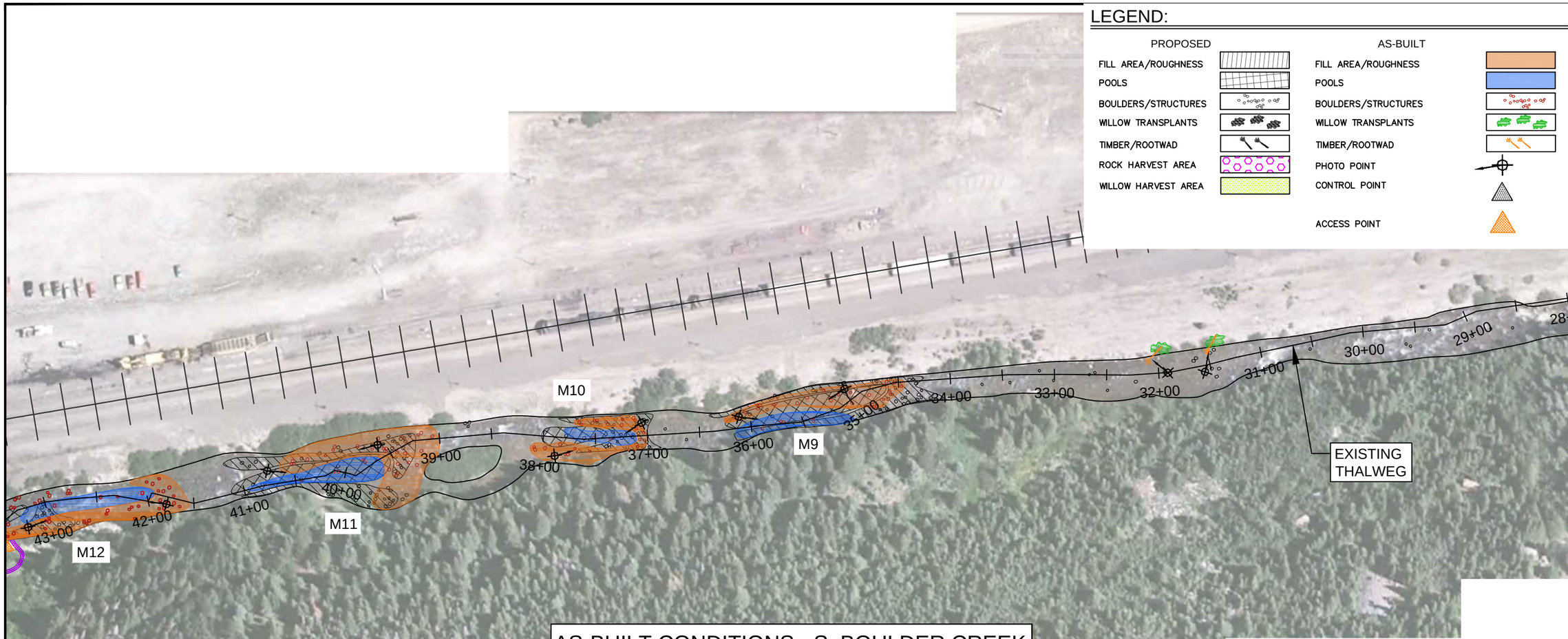

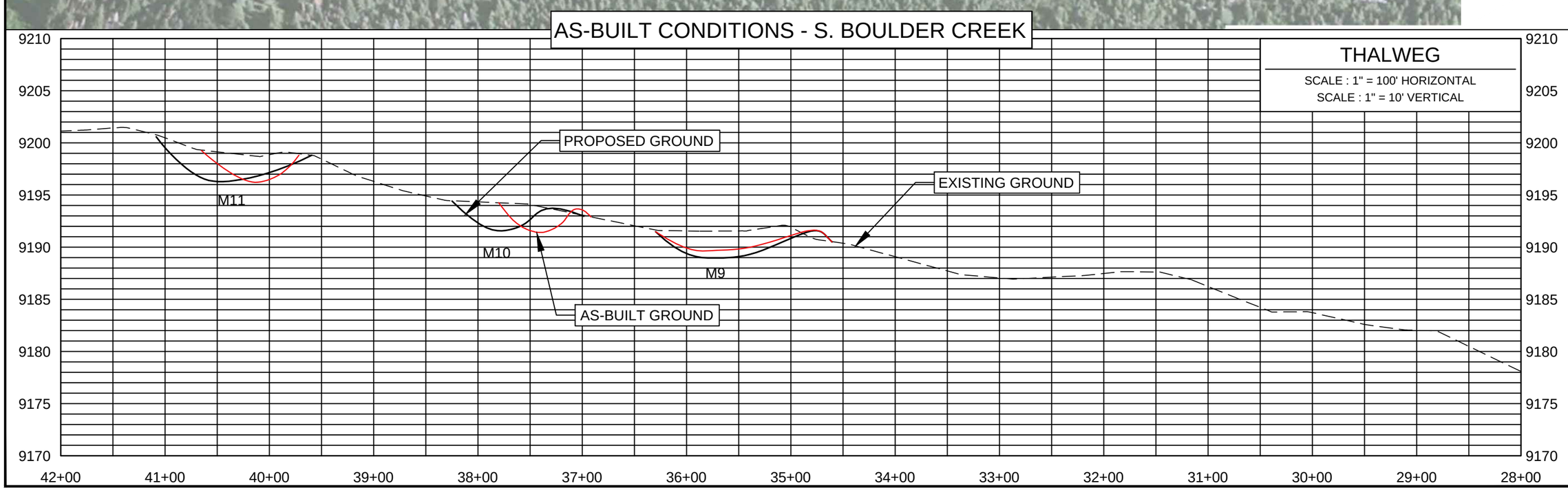

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AS-BUILT IMPROVEMENTS
SITE 1 - MOFFAT TUNNEL
SOUTH BOULDER CREEK
GILPIN COUNTY, COLORADO

1C

PL. SCALE: 1"=100'
DATE: NOVEMBER 2013

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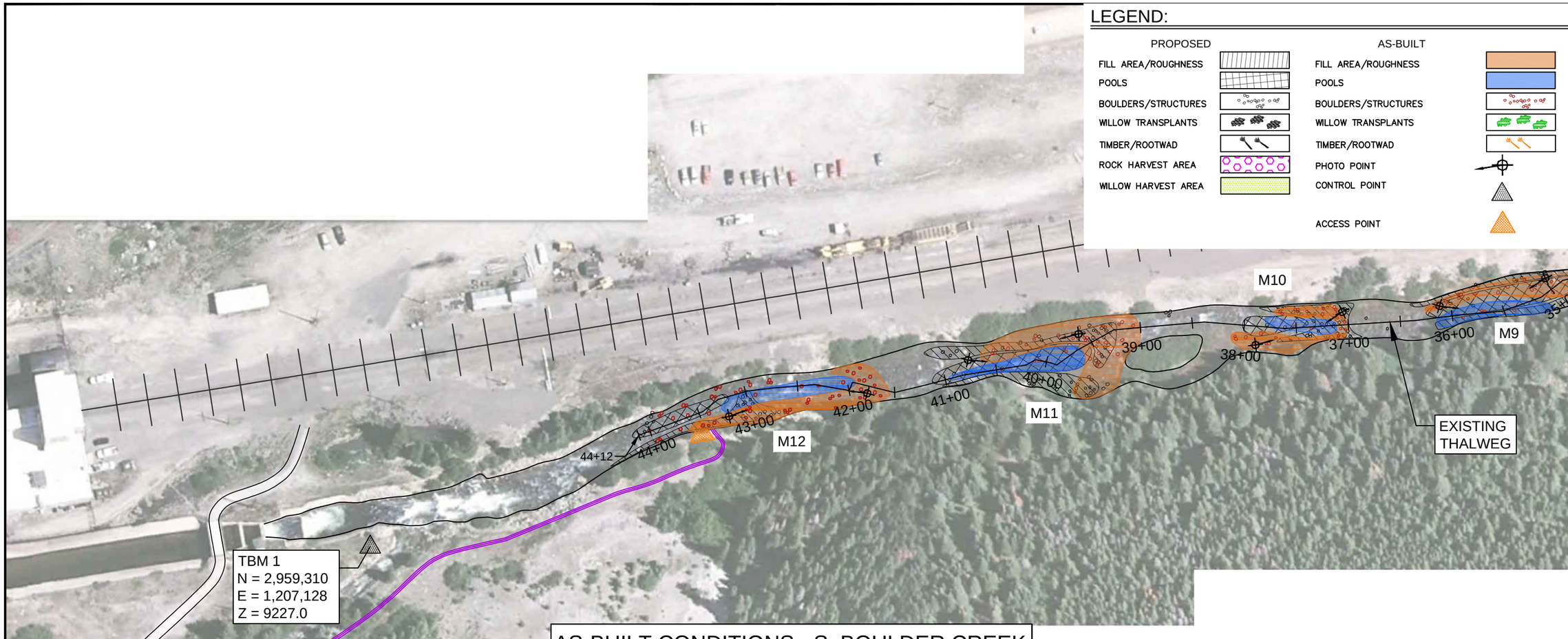

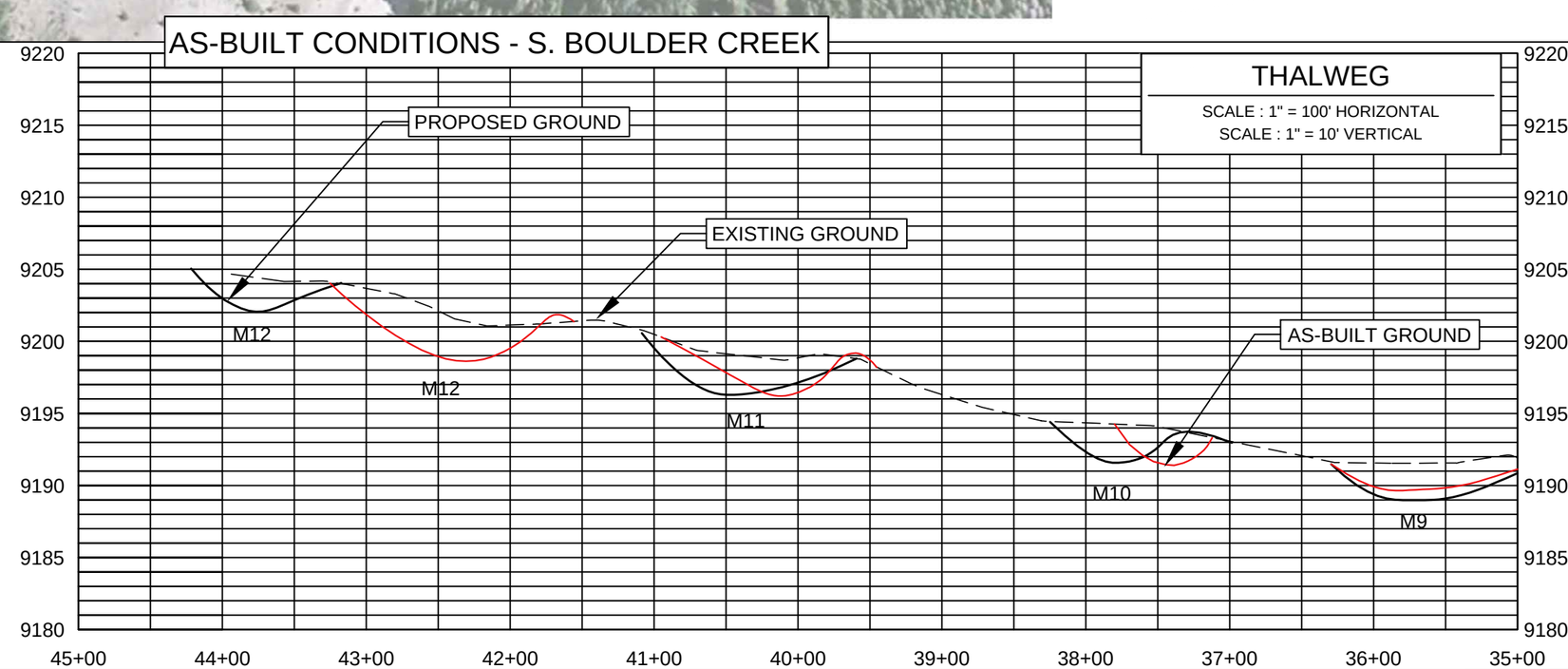

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GILPIN COUNTY, COLORADO

1D

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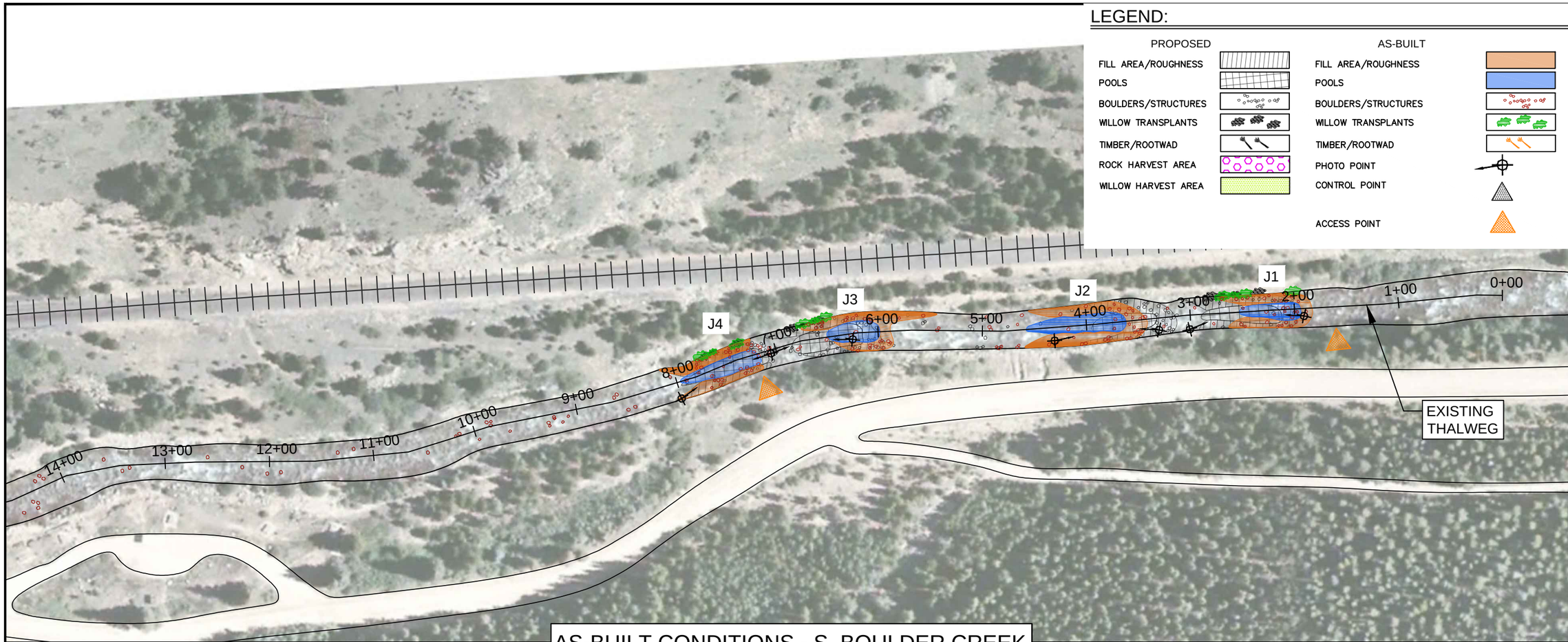
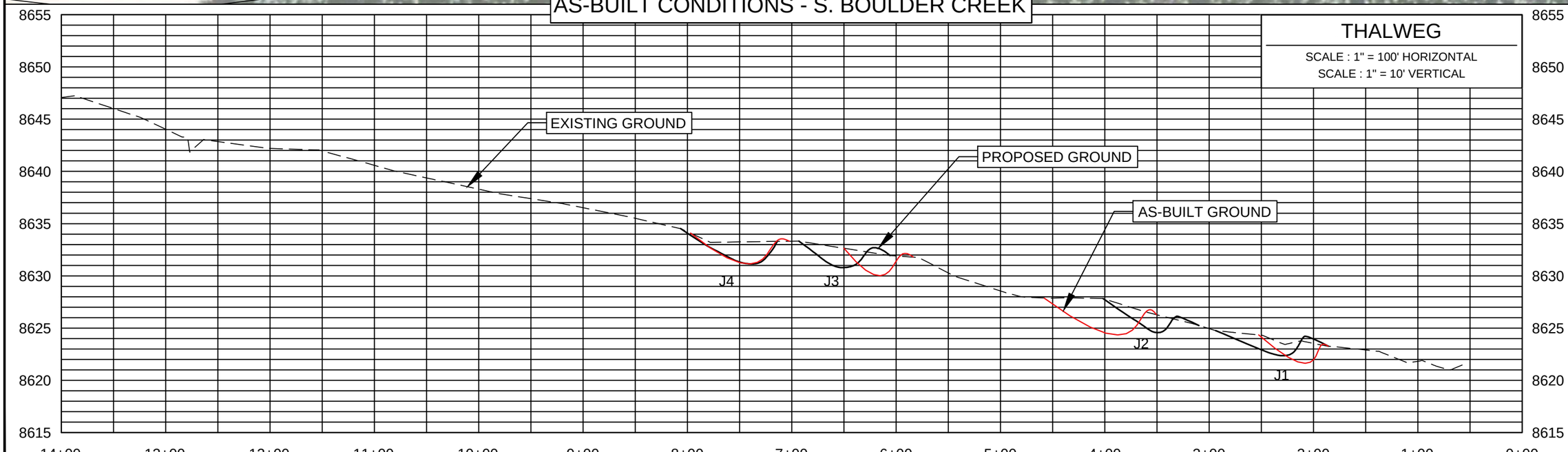


AS-BUILT CONDITIONS - S. BOULDER CREEK



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AS-BUILT IMPROVEMENTS
SITE 2 - JUMBO MOUNTAIN
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GILPIN COUNTY, COLORADO

2A

PL. SCALE: 1"=100'
DATE: NOVEMBER 2013

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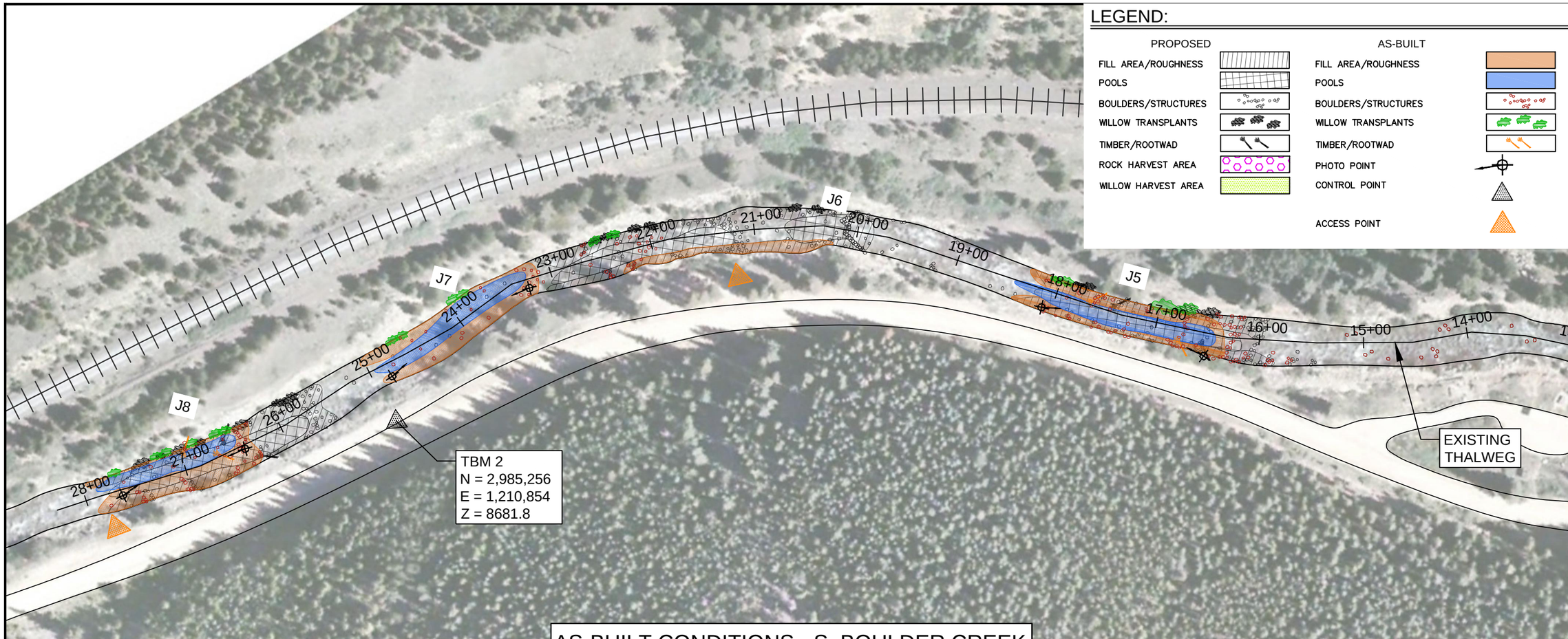

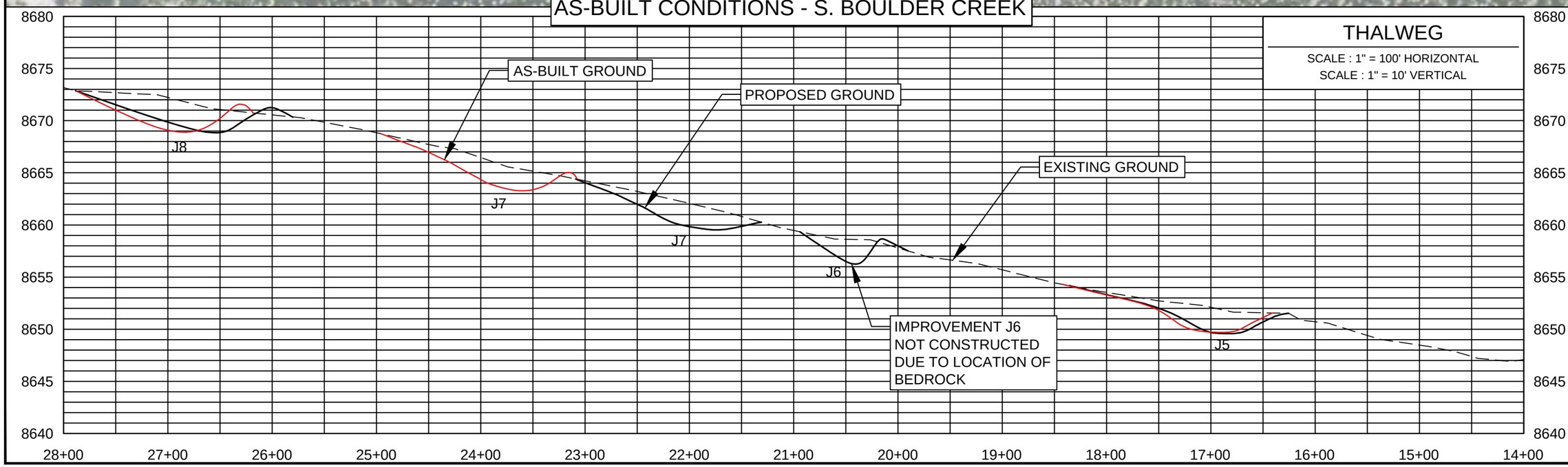

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