MRG Bernalillo to Belen GRR

Appendix A

Civil Design

December 2019

US Army Corps
of Engineers

Albuquerque District
South Pacific Division

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Table of Contents

1 - PROJECT DESCRIPTION

1.1 PROJECT DESCRIPTION

The Tentatively Selected Plan represents a feasibility level planning and design for approximately 48 miles that is along the east (22 miles) and west (26 miles) banks of the Rio Grande. The project begins south of the Albuquerque city limits at the South Diversion Channel to south of the Highway 47 bridge approximately 1.6 miles in Belen. The primary feature of the plan is replacement of the existing spoil bank with an engineered levee which runs almost the entire length of the project. The project area has been broken down into four units: Mountain View, Isleta West (Reach 1 and 2), Belen East and Belen West Units. The project also includes several other appurtenant features. Features include concrete box culverts, spoil bank levee excavation, reinforced concrete pipes, headwalls, and articulated concrete block revetment mat and levee riprap embankment protection for erosion control at locations vulnerable to erosion from high river velocities. Appurtenant features are described in the following paragraphs.

1.2 SURVEYING, MAPPING AND OTHER GEOSPATIAL DATA

Aerial Light Detection and Ranging (LiDAR) data acquisition and processing formed the primary source for development of 1-foot equivalent contour interval Digital Terrain Model (DTM) and related topographic/elevation information. DTM data were compiled to meet one-foot (1') contour interval data-vertical accuracy at the 95% confidence level (RMSE of 0.33). Ninety-five percent of well-defined features are expected to be within 0.3 feet of their true position on the ground. The horizontal accuracy limits for well-defined points are expected to be consistent with control defined for the 2010 Mid-Region Council of Governments (MRCOG) Orthophotography Project within at least 2â€™ feet of their true coordinates using NM State Plane Central Zone (3002) NAD83(HARN), NAV88, US Survey Feet, Geoid 09. See attachments for metadata files.

The image tiles used in the plan's background is part of an orthophotography project covering areas of interest in and adjacent to the jurisdiction boundary of the Mid Region Council of Governments (MRCOG) in central New Mexico. The digital orthophotography and elevation data were obtained in 2010. The image conforms to American Society for Photogrammetry and Remote Sensing (ASPRS) Class I Standards for 1"=200' mapping. Coordinate systems were based off the New Mexico State Plane Central Zone projection with the horizontal datum North American Datum 1983 (1992)/HARN and vertical datum North American Vertical Datum 1988 and units of US Survey Feet.

1.3 ALIGNMENT

The alignments were initially placed at the approximate center of the existing spoil bank. Several iterations were evaluated to minimize the amount of Bosque that would need to be mitigated and ensure that a 20-feet wide maintenance road at the toe of the engineered levee along the Riverside

Drain was maintained. Due to the erosion and sloughing of the Riverside Drain side-slopes it was necessary to obtain additional survey to identify the center of the Riverside Drain in order to place the alignment closer to the original Riverside Drain configuration and thereby reducing the amount of Bosque that would need to be mitigated.

1.4 LEVEE

An existing spoil bank serves as the current levee on the east and west side of the Rio Grande. The existing spoil banks were constructed from the soil waste excavated from the Riverside Drain and not considered adequate to withstand a flood event. This project will include removal of the existing spoil bank and an engineered levee will be reconstructed in its place. Suitable material excavated from the spoil banks will be reused to reconstruct the new levee. All four levee units will have 15-feet wide crest, a 20-feet wide minimum maintenance road from the Riverside Drain top of bank to the toe of the levee. The 20-foot wide maintenance road is required for foundation seepage. Side-slopes of the levee will be 1 vertical (V) on 2.5 horizontal (H) for levee heights equal to or less than 12-feet. Levee heights exceeding 12-feet will have 1V on 3H side-slopes. Due to the sloughing and unstable side slopes of the Riverside Drain, the adjacent side-slope of the drain will be rehabilitated to approximately 1 vertical (V) on 2.5 horizontal (H) to ensure the stability of the toe drain. The Sponsor (MRGCD) will be doing an analysis of the Riverside Drain as a part of their cost-share agreement and will provide us with the required configuration of the Riverside Drain at a later date. Toe drains within the levee will be required on the landside toe to control seepage and eliminate sloughing. The distance between toe drain risers will be at 400-feet intervals. On the riverside levee toe, there is a 15-feet wide vegetation free zone. The typical levee section selected will have a 5-feet deep, 8-feet wide with 1V on 1 H side-slopes inspection trench. Refer to Typical Levee Sections and Details sheet for each Unit in the drawing set.

Mountain View Unit. Mountain View Unit begins on the east side of the Rio Grande and is the most northern levee. Mountain View Unit starts at station 0+25.00 south of the South Diversion Channel is situated between the Rio Grande, on the west, with the Riverside Drain on the east side of the levee. The same typical section is carried throughout the Mountain View Unit reach. The Mountain View Unit ties into high ground on the north side of Interstate 25 at station 229+88.87 (approximately 4.4 miles). The existing spoil bank height along the Mountain View reach varies from 4 feet to 23 feet with varying side slopes. The new levee height corresponds to 4 feet above the 100-year water surface elevation. A 10-feet wide bike trail will be constructed on the side of the riverside drain of the levee toe adjacent to the 20-feet wide maintenance road. The bike trail was a feature the City of Albuquerque requested in this reach. An unimproved, shared use trail utilizing an existing maintenance access road may be designated within the footprint of the new levee from the South Diversion Channel to Valle del Oro National Wildlife Refuge.

Belen East Unit. Belen East Unit is the second unit south of the Mountain View Unit on the east side of the Rio Grande and begins just north of NM 147 at station -0+00.40 and ties in along the north side of NM 147. The levee picks up on the south side of NM 147 and ties in at the north side of Historic Route 66. The Belen East levee continues south of Historic Route 66 and ends at station 950+00. The Belen East Unit is approximately 18 miles long. The new levee height for this unit corresponds to 5-feet above the 100-year water surface elevation. The Belen East Unit levee crosses drains or ditches that will require seven concrete pipes and/or culverts to be installed. See Section 1.5 Concrete Box Culvert (CBC) and Pipes for locations and sizes information. All tie-ins to high ground road crossings will be addressed during the Pre-Construction Engineer and Design (PED) phase using stop log structures. During PED phase all options for the closure structures will be coordinated with the Levee Safety Program Manager (LSPM) and Sponsor. The NM 6 crossing is to be reconstructed and levee heights have been coordinated with NM DOT Engineer (with Parsons Brinckerhoff) to raise the roadway to the top of the levee. All costs associated with the road crossings were captured by contingency in the Risk Analysis.

Isleta West Unit. Isleta West Unit begins on the south side of Interstate 25 with the Atrisco Riverside Drain on the west side of the levee at station 0+00 (Reach 1). The levee alignment crosses over the Atrisco Riverside Drain at approximately station 50+00 (Reach 1) where a new 5’H x 10’W CBC with gate and headwall will be constructed. Atrisco Riverside Drain remains on the east side of the levee and the levee will tie back into high ground along the Burlington Northern Santa Fe (BNSF) Railroad (End of the Reach 1). The Isleta West Unit (Reach 2) will then begin along the east side of BNSF Railroad and run southwest along the Isleta Riverside Drain. The levee is on the east side of the drain. The Isleta West Unit (Reach 2) levee will tie into existing ground north of Highway147 at station 83+44.47. The beginning of the Isleta West Unit (Reach 2) will be addressed during PED and the cost was captured in the contingency. The proposed height of Reach 1 and 2 levee corresponds to 4 feet above the 100-year water surface elevation. The Isleta West Unit levee will have side slopes of 1V on 2.5H. The Isleta West Unit (Reach 1) levee crosses the Atrisco Riverside Drain in two locations and will require concrete box culverts with gates to be installed. The Isleta West Unit is approximately 3 miles long. See Section 1.5 Concrete Box Culvert (CBC) and Pipes for locations and sizes information.

Belen West Unit. Belen West Unit begins at station 0+50.00 just east of Highway 314 and adjacent to the Rail Runner Express. During the Pre-Construction Engineering and Design (PED) phase the levee will extend past the railroad and Highway 314 to high ground and closures will be designed for the railroad and Highway 314. Costs is covered in the Risk Analysis. The Belen West alignment follows the 240 Wasteway and turns south along the Upper Belen Riverside Drain at approximately station 10+00. A 5’H x 10’W CBC will be constructed through the proposed levee to carry water from the Wasteway to the Rio Grande. A 48-inch RCP will be constructed through the levee to allow the flows to pass through the Upper Belen Riverside Drain. Both culvert and pipe will be gated on the river side. The Belen West levee continues along the Upper Belen Riverside Drain and terminates north of Main St. The levee begins south of Main St. and follows along the east side of the Upper and Lower Belen Riverside Drain until it ties into existing ground at station 823+20.65 just adjacent to NM 309. In this reach a 60-inch RCP will be installed through the levee with a gate on the downstream end. The levee begins at station 824+96.29 and continues until it ties into high ground at station 908+58.25 at Atchison Topeka and Santa Fe (ATSF) Railroad. A 5’H x 10’W CBC will be constructed through the levee to allow water from the Lower Belen Wasteway to flow to the Rio Grande. The CBC will be gated on the river side. Adjacent to the Wasteway is the Belen Riverside Drain where an 8’H x 10’W CBC will be constructed through the levee. On the south side of the Atchison Topeka and Santa Fe (ATSF) Railroad the levee begins at station 910+60.17 and continues south along the east side of the Lower Belen Riverside Drain to station 1169+48.02 where it terminates. The proposed top of levee for the Belen West Unit corresponds to 5 feet above the 100-year water surface elevation. The levee will have side slopes of 1V on 3H. The Belen West Unit is approximately 23 miles long.

1.5 CONCRETE BOX CULVERTS AND PIPES

Mountain View Unit.

-A 5'H x 10'W ungated concrete box culvert at approximately station 228+00 where the levee crosses the drain just north of I-25 will be installed.

Belen East Unit.

-The levee crosses the Barr Chicla Diversion just north of NM 147. A 5'H x 10'W concrete box culvert will be installed at station 1+45± with a gate on the downstream end of the culvert.

-South of NM 147 adjacent to the Isleta Diversion Structure there are five ditches where the levee will cross. Concrete box culverts and pipes will be constructed to allow the water to flow in the ditches with a gate on the downstream ends. Their locations and sizes are listed below:

Sta. 10+50± - 5'H x 10'W Gated CBC
Sta. 11+35± - 5'H x 10'W Gated CBC
Sta. 11+85± - 48" Dia. Gated RCP
Sta. 13+20± - 36" Dia. Gated RCP
Sta. 13+90± - 8'H x 10'W Gated CBC

- A 5'H x 10'W CBC will be installed on the Peralta Main Canal at sta. 890+95± were the levee crosses. The gate will be installed on the riverside end of the culvert.

Isleta West Unit.

- Station 1+05± a 5'H x 10'W CBC will installed through the levee on the Atrisco Riverside Drain. The new CBC will be tied into the existing CBC upstream and does not require a gate.

-Station 50+10± a 5'H x 10'W CBC will be installed through the levee on the Atrisco Riverside Drain. A gate will be installed on the downstream end of the CBC.

Belen West Unit.

- Station 8+75± a 48-inch RCP with gate on the river side will be constructed through the levee to allow the flows to pass through the Upper Belen Riverside Drain.

-Station 10+70± a 5'H x 10'W CBC will be installed through the proposed levee to carry water from the Wasteway to the Rio Grande. A gate will be installed on the river side.

-Station 437+30± a 60-inch RCP will be installed through the levee with a gate on the downstream end.

-Station 907+00± a 5'H x 10'W CBC will be installed through the levee to allow water from the Lower Belen Wasteway to flow to the Rio Grande. The concrete box culvert will be gated on the river side.

-Station 907+60± adjacent to the Wasteway is the Belen Riverside Drain an 8'H x 10'W CBC will be constructed through the levee. The CBC will follow the Belen Riverside Drain alignment for approximately 900 feet and where it crosses the levee at station 914+14±. No gates are required.

-Station 925+10± a 5'H x 10'W concrete box culvert will be installed through the levee to allow irrigation water through. Gate will be required on the riverside.

1.6 LEVEE RIPRAP SLOPE PROTECTION

Slope protection is required in specific areas of the project that have been identified areas of the river where scour protection is required from a possible headcut developing in the river. The levee riprap slope protection for all units will be 2.5 feet thick and keyed at the toe for a depth of 3 feet. The levee riprap slope protection will be placed 2 feet from the top of the levee. Reference the Appendix A-Civil drawings for limits of levee slope protection. Reference Geotechnical Section of this report for compaction and placement requirement and Hydrology and Hydraulics section of this report for specifics.

1.7 EROSION CONTROL FOR CONCRETE BOX CULVERTS AND PIPE

At the ends of the new concrete pipes and concrete box culverts an18-inch thick riprap blanket will be required. Overall sizes of the riprap blankets vary. Reference the Appendix A-Civil drawings for dimensions.

1.8 ARTICULATED CONCRETE BLOCK REVETMENT MAT

Articulated concrete block revetment mat will be required along the areas of the Riverside Drain where the bank height is greater than 5-feet. This is done in order to protect the Riverside Drain from the sloughing due to the foundation seepage.

1.9 ACCESS RAMPS

Access ramps from the levee to the Riverside Drain maintenance road have not been identified on the plan and profile sheets. However, the access ramp quantities were quantified in the cost estimate. Middle Rio Grande Conservancy District (MRGCD) requires access ramps every 1000-feet. Access ramps for this project will be constructed to follow the design parameters identified in EM 1110-2-1913; 15-foot top width, 1V on 10H maximum slope, 1V on 3H side-slopes, and suitable gravel surface for all-weather access.

2 - REAL ESTATE

Property within the footprint of our project is managed by the Bureau of Reclamation (BOR) and maintained and operated by the Middle Rio Grande Conservancy District (MRGCD). Borrow and disposal sites are to be located on the MRGCD property.

2.1 UTILITIES

Four utilities cross the Belen West Unit levee alignment have been identified. These are: Two power lines at station 976+37± and station 990+50± and two high pressure gas lines at station 1114+46± and station 1135+85±. It is uncertain if these utilities will need to be relocated because of their height.

3 - ATTACHMENTS

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This elevation dataset provides LiDAR-derived elevation data with supplemental stereo photogrammetric break line collection for Digital Terrain Model (DTM) development covering 1,205 tiles (modified Public Land Survey System (PLSS)) established for 2010 Mid-Region Council of Governments (MRCOG) Orthophotography Project and named according to USACE specifications. Each data tile is approximately 0.25 square miles in size.

<purpose>Aerial Light Detection and Ranging (LiDAR) data acquisition and processing formed the primary source for development of 1-foot equivalent contour interval Digital Terrain Model (DTM) data and related topographic / elevation information. The DTM data have also been “hydro-enforced” with break line supplementation. LiDAR-derived bare-earth DTM data are projected according project control specifications established for the 2010 Mid-Region Council of Governments (MRCOG) Orthophotography Project: NM State Plane Central Zone (3002) NAD83(HARN), NAVD88, US Survey Foot, Geoid 09. Elevation data covering approximately 303 square miles in the Rio Grande valley floodplain in Bernalillo, Sandoval, Socorro and Valencia counties, New Mexico, were developed to support USACE scientists in geomorphic studies for the Upper Rio Grande Water Operations Model (URGWOM) and the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP). URGWOM is a computational model developed through an interagency effort and is used to simulate processes and operations of facilities in the Rio Grande Basin in New Mexico from the Colorado state-line to EI Paso, Texas (flood control operations only below Caballo Dam) and complete accounting calculations for tracking the delivery of water allocated to specific users. The purpose of the MRGESCP is to protect and improve the status of endangered species in the middle Rio Grande valley while simultaneously protecting existing water uses. The main goal of the USACE geomorphic study is to answer a variety of complex landscape habitat interrelated questions that will lead to better management downstream of the four USACE dams functioning within the Rio Grande watershed. The initial objective is to collect the necessary information for a geomorphic assessment of the Rio Grande. One of the first steps for the assessment is to obtain topographic information along the riverine corridor of the Rio Grande from Cochiti Dam to the headwaters of Elephant Butte Reservoir (BOR Mile Marker 60). These data will be used to build a detailed hydraulics model that will be used to assess current sediment transport characteristics of the Rio Grande. These data will also be used in other concurrent USACE projects to design aquatic and riparian habitat restoration features and develop groundwater-surface water models.</purpose>

<supplinf>The bounding rectangle provided within the Geographic Extent metadata section represent the Project Area in which the Digital Terrain Model (DTM) surface elevation data for this Project is located. This Project developed deliverable data derived from the integration of multiple sources of elevation information including: LiDAR data and supplemental break lines collected from Intergraph DMC® stereo digital photography captured as part of the Digital Ortho-photography Project 2010. A total of 1,205 modified U.S. Public Land Survey System (PLSS) tiles (with overlap) of DTM data are included in the entire Project. Deliverables include Point_Cloud (las) format of raw LiDAR points and LiDAR-derived, tiled, "bare earth" DTM data deliverables across the Project includeing the following data: - Point_Cloud_Classified (las) format of classified LiDAR points, and Bare-Earth_DTM data including: - ArcGIS Grid (asc)

format at 3.0 foot grid resolution; - ArcGIS line Shapefile format for DTM Breaklines, - ArcGIS line Shapefile format for DTM Points, - CADD/ASCII format lin-.txt and pnt-.txt format for point and line DTM points and breaklines, and Shaded Relief (GeoTIFF) format images</supplinf>

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<datacred>Funding for this Project was assembled under a collaborative effort among the Mid-Region Council of Governments (MRCOG), the US Army Corps of Engineers – Albuquerque District (USACE), and the US Geological Survey (USGS). Acknowledgements of

the MRCOG, USACE, USGS and Bohannan-Huston, Inc. would be appreciated for products derived from these data.</datacred>

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<attraccr>DTM data were compiled to meet one-foot (1') contour interval data-vertical accuracy at the 95% confidence level (RMSE of 0.33). Ninety-five percent of well-defined features are expected to be within 0.3 feet of their true position on the ground. The horizontal accuracy limits for well-defined points of are expected to be consistent with control defined for the 2010 MRCOG Orthophotography Project within at least 2' feet (ASPRS Class 1 Mapping Standards for 1"= 200') of their true coordinates.</attraccr>

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<logic>DTM features in this data set were collected from a variety of active and passive remote sensing technologies including LiDAR (Light Detection and Ranging) and large scale aerial photography utilizing stereo photogrammetric break line collection. Stereo 3D breakline collection and surface treatment included primarily drainage ditches guided by The Middle Rio Grande Conservancy District (MRGCD) facilities network reference data. Areas of concentrated breakline work also included Levee and River features as well as Road and Railroad features and Bridges on major infrastructure intersecting the Rio Grande River.</logic>

<complete>Deliverable data tiles were inspected to ensure complete terrain data coverage within tiles and therefore tiles may be comprised of multiple data sources including both classified LiDAR point data and stereo photogrammetrically collected breaklines. Sources covering the Project Areas are defined by Source Information collected from ground survey as well as aerial remote sensing (Digital Aerial Image and LiDAR) data collection in 2010.</complete>

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classes using the 2001 National Landcover Database (NLCD) (30m res). According to the these data there are three principal land cover categories within the Project Boundary which occupy more than 10% (by area) of the Project Area: Developed (Low/Medium/High Intensity & Open Space) (24%), Scrub/Shrub (26%), and Planted/Cultivated (Pasture and Cultivated Crops) (36%). More than 60 control points fall in these land cover categories, meeting NSSDA testing regime requirements of at least 20 points. Control was draped on the final elevation surface model to calculate the difference in elevation values between the DTM surface and the vertical control points used to test the DTM data. Elevation values of the independent and the test points were transferred to the Federal Geographic Data Committee (FGDC) Vertical accuracy calculation spreadsheet to develop the project RMSE and NSSDA vertical accuracy statistics. Reported accuracies are developed from total of 185 points ranging in vertical differences, ranging between -0.5 and +0.5.</vertacce>

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<purpose>Aerial Light Detection and Ranging (LiDAR) data acquisition and processing formed the primary source for development of 1-foot equivalent contour interval Digital Terrain Model (DTM) data and related topographic / elevation information. The DTM data have also been “hydro-enforced” with break line supplementation. LiDAR-derived bare-earth DTM data are projected according project control specifications established for the 2010 Mid-Region Council of Governments (MRCOG) Orthophotography Project: NM State Plane Central Zone (3002) NAD83(HARN), NAVD88, US Survey Foot, Geoid 09. Elevation data covering approximately 303 square miles in the Rio Grande valley floodplain in Bernalillo, Sandoval, Socorro and Valencia counties, New Mexico, were developed to support USACE scientists in geomorphic studies for the Upper Rio Grande Water Operations Model (URGWOM) and the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP). URGWOM is a computational model developed through an interagency effort and is used to simulate processes and operations of facilities in the Rio Grande Basin in New Mexico from the Colorado state-line to EI Paso, Texas (flood control operations only below Caballo Dam) and complete accounting calculations for tracking the delivery of water allocated to specific users. The purpose of the MRGESCP is to protect and improve the status of endangered species in the middle Rio Grande valley while simultaneously protecting existing water uses. The main goal of the USACE geomorphic study is to answer a variety of complex landscape habitat interrelated questions that will lead to better management downstream of the four USACE dams functioning within the Rio Grande watershed. The initial objective is to collect the necessary information for a geomorphic assessment of the Rio Grande. One of the first steps for the assessment is to obtain topographic information along the riverine corridor of the Rio Grande from Cochiti Dam to the headwaters of Elephant Butte Reservoir (BOR Mile Marker 60). These data will be used to build a detailed hydraulics model that will be used to assess current sediment transport characteristics of the Rio Grande. These data will also be used in other concurrent USACE projects to design aquatic and riparian habitat restoration features and develop groundwater-surface water models.</purpose>

<supplinf>The bounding rectangle provided within the Geographic Extent metadata section represent the Project Area in which the Digital Terrain Model (DTM) surface elevation data for this Project is located. This Project developed deliverable data derived from the integration of multiple sources of elevation information including: LiDAR data and supplemental break lines collected from Intergraph DMC® stereo digital photography captured as part of the Digital Ortho-photography Project 2010. A total of 1,205 modified U.S. Public Land Survey System (PLSS) tiles (with overlap) of DTM data are included in the entire Project. Deliverables include Point_Cloud (las) format of raw LiDAR points and LiDAR-derived, tiled, "bare earth" DTM data deliverables across the Project includeing the following data: - Point_Cloud_Classified (las) format of classified LiDAR points, and Bare-Earth_DTM data including: - ArcGIS Grid (asc) format at 3.0 foot grid resolution; - ArcGIS line Shapefile format for DTM Breaklines, - ArcGIS line Shapefile format for DTM Points, - CADD/ASCII format lin-.txt and pnt-.txt format for point and line DTM points and breaklines, and Shaded Relief (GeoTIFF) format images</supplinf>

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<datacred>Funding for this Project was assembled under a collaborative effort among the Mid-Region Council of Governments (MRCOG), the US Army Corps of Engineers – Albuquerque District (USACE), and the US Geological Survey (USGS). Acknowledgements of the MRCOG, USACE, USGS and Bohannan-Huston, Inc. would be appreciated for products derived from these data.</datacred>

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<attraccr>DTM data were compiled to meet one-foot (1') contour interval data-vertical accuracy at the 95% confidence level (RMSE of 0.33). Ninety-five percent of well-defined features are expected to be within 0.3 feet of their true position on the ground. The horizontal accuracy limits for well-defined points of are expected to be consistent with control defined for the 2010 MRCOG Orthophotography Project within at least 2' feet (ASPRS Class 1 Mapping Standards for 1"= 200') of their true coordinates.</attraccr>

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<logic>DTM features in this data set were collected from a variety of active and passive remote sensing technologies including LiDAR (Light Detection and Ranging) and large scale aerial photography utilizing stereo photogrammetric break line collection. Stereo 3D breakline collection and surface treatment included primarily drainage ditches guided by The Middle Rio Grande Conservancy District (MRGCD) facilities network reference data. Areas of concentrated breakline work also included Levee and River features as well as Road and Railroad features and Bridges on major infrastructure intersecting the Rio Grande River.</logic>

<complete>Deliverable data tiles were inspected to ensure complete terrain data coverage within tiles and therefore tiles may be comprised of multiple data sources including both classified LiDAR point data and stereo photogrammetrically collected breaklines. Sources covering the Project Areas are defined by Source Information collected from ground survey as well as aerial remote sensing (Digital Aerial Image and LiDAR) data collection in 2010.</complete>

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<vertacce>DTM data were tested with more than 180 points according to NSSDA testing methodology (http://www.fgdc.gov/standards/projects/FGDC-standards-projects/accuracy/part3), utilizing primary photo control from the Digital Orthophotography Project 2010. Control points used in this project for assessment purposes are considered to meet "well-defined" point criteria status. Control points were also analyzed to assess distribution of control over Project land cover classes using the 2001 National Landcover Database (NLCD) (30m res). According to the these data there are three principal land cover categories within the Project Boundary which occupy more than 10% (by area) of the Project Area: Developed (Low/Medium/High Intensity & Open Space) (24%), Scrub/Shrub (26%), and Planted/Cultivated (Pasture and Cultivated Crops) (36%). More than 60 control points fall in these land cover categories, meeting NSSDA testing regime requirements of at least 20 points. Control was draped on the final elevation surface model to calculate the difference in elevation values between the DTM surface and the vertical control points used to test the DTM data. Elevation values of the independent and the test points were transferred to the Federal Geographic Data Committee (FGDC) Vertical accuracy calculation spreadsheet to develop the project RMSE and NSSDA vertical accuracy statistics. Reported accuracies are developed from total of 185 points ranging in vertical differences, ranging between -0.5 and +0.5.</vertacce>

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<srccontr>LIDAR data was captured using a Leica Geosystems ALS50II LIDAR system mounted with an inertial measurement unit (IMU) and dual frequency GPS receiver. Primary project acquisition with this LiDAR sensor occurred between on three dates: 3/12/2010, 3/13/2010 and 4/28/2010. During data acquisition, a base station GPS receiver established and collected phase GPS data simultaneous to airborne LiDAR collection performed at a according to the planned LiDAR Flight Parameters (LiDAR_FlightParameters.xlsx). The Upper Middle Rio Grande (LDRUPA_planned.shp) was collected at a planned flying height of 7,545 feet above ground level (AGL), while the remaining project areas (LDR5YR_planned.shp) were collected at a planned flying height of 8,241 feet AGL.</srccontr>

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<srccontr>Digital aerial imagery was collected at a nominal average altitude of 5,700 feet above mean terrain (AMT) using the Intergraph Digital Mapping Camera (DMC®) (120 mm focal length). Designed for capture of a 6-inch pixel nominal ground sample distance (GSD) image, the DMC aerial imagery served the dual purpose of supporting both 0.50 foot GSD resolution digital orthorectification as well as 3D stereo review and break line supplementation of LiDAR-Derived “Bare Earth” DTM products.</srccontr>

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</cntaddr>
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