Section VI
Preliminary Surveys

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VI. Preliminary Surveys

A. Introduction

This section provides a general description of the preliminary surveying process. The primary objective in this process is the collection of survey data through a variety of methods. Once collected, the data is used to create two-dimensional (2-D) and three-dimensional (3-D) mapping files. These mapping files created by the Photogrammetry & Surveys Section (P&S) are then used in the design and construction phases.

In order to provide accurate mapping files, the collection of individual features must meet or exceed defined standards. For more information on acceptable tolerances for each WYDOT feature code refer to Section VIII, Survey Standards, in this manual. Technical aspects of data collection are discussed in detail elsewhere in this manual and in the Data Collection Manual.

1. Surveying Activities

The collection of preliminary surveys consists of numerous activities associated with the mapping of each project. Because there are many individuals from different programs and sections involved in the preliminary survey process, communication is critical. Conducting a survey meeting, determining landowners, obtaining permission to survey, and establishing a project control network are all necessary steps. These tasks must be completed before any preliminary survey data can be collected.

There are many categories of surveys that collect different types of information. Control surveys, topographic surveys, utility surveys, geology surveys, and wetland surveys are examples of preliminary surveys. The information gathered is used to create planimetric maps and digital terrain models (DTM's).

2. Project Schedule

WYDOT Operating Policy 18-3 defines the procedures for each project in the State Transportation Improvement Plan (STIP). These procedures outline the development and issuance of contract plans and documents. To schedule all of the activities associated with the development of a project, WYDOT uses a "critical-path" project control system (PCS). The PCS schedule identifies dates when each activity should be started and completed. Adherence to the PCS schedule will keep each project on-track to meet its projected letting date.

Some preliminary survey activities are dependent on seasonal and weather variations. Aerial photography cannot take place in the winter months due to low sun angles that create excessive shadows. Also, high winds, cloudy skies, or snow cover can delay a scheduled flight. These conditions contribute to less than ideal imagery used by the Photogrammetry group to create mapping files. Consequently, the scheduling and completion of this task becomes more critical than other preliminary survey activities.

3. Safety

There are always safety concerns during preliminary surveying activities. Each surveyor must be aware of safety issues involving traffic, underground utilities, power lines, and confined spaces. The surveyor must follow accepted practices to minimize the risk when

confronted with these dangerous environments. In particular, the "Wyoming High Voltage Power Lines and Safety Restrictions Act", W.S. 37-3-301 et seq., should be reviewed before working in the vicinity of power lines. This statute requires notification be given to the power company prior to commencement of work near power lines. The survey equipment used and the proximity to the overhead utilities should be evaluated to determine if such contact is warranted.

B. The Preliminary Surveying Process

1. Survey Meeting

After the project reconnaissance inspection has been held, the State Photogrammetry & Surveys Engineer will schedule a survey meeting. The purpose of the survey meeting is to determine a schedule and assign responsibilities for the preliminary activities. The participants in the survey meeting are representatives from Photogrammetry & Surveys, Resident Engineer's office, Project Development, and Right-of-Way. Other participants may include personnel from Bridge, Hydraulics, Geology, District Engineer's office, and design consultants. Typical survey meeting topics include but are not limited to the following items:

- Location, scope, and intent of the project
- Land ownership & control (LOCO) map
- Acquiring permission to survey
- Type of survey (aerial or field collected)
- Photo control spacing and layout
- Mapping and design plan scale
- Annotation of project and photo control
- Annotation of utilities, culverts, fencing, etc.
- Project control layout, utility locates, and setting monuments
- Project and photo control naming conventions
- Collection of project and photo control surveys
- Collection of preliminary survey features
- Feature code list (e.g. PS09 or PS15)
- Survey data format (e.g. Trimble *.dc file or coordinate text file formats)
- Land survey requirements

A draft report of the survey meeting minutes will be written by P&S personnel and distributed to all participants for review and comment. After a brief review period, the final survey meeting report will be made available. Currently, the final report is being placed in the Falcon document management system.

Depending on the workload, P&S may involve the Resident Engineer's office or a consulting firm to perform specific activities. These activities may include but are not limited to

creating a LOCO map, obtaining permission to survey, setting project control monuments, placing aerial targets, establishing vertical control, or collecting preliminary survey data.

2. Land Ownership and Permission to Survey

a. Land Ownership & Control Map

Development of a Land Ownership and Control (LOCO) map is the first step in getting permission to access private and public land. The main purpose of the LOCO map is to determine property ownership adjacent to the highway right-of-way. These land parcels may be affected by preliminary surveying activities. Most of the information for the LOCO maps may be accessed through the county assessor's GIS website or the Wyoming Statewide Parcel Viewer.

A LOCO map is typically created in a CADD design file, but they may also be produced on county assessor maps (plats). Other formats may be used with approval from the State Photogrammetry & Surveys Engineer.

The LOCO map must include a title block with the project name, section, and number. Other important items to include in the title block are:

- Name of the map preparer
- County or counties where the project is located
- Date map was completed
- LOCO map scale
- Total number of sheets
- Land owner table listing owners and lessees

The land owner table assigns a number to each land owner and/or lessee and indicates if permission to survey has been granted. The permission to survey (P.T.S.) status on the landowner table should be marked with a "Yes" or "No". A numbering and/or crosshatching system should be used to link the land owners/lessees with each land parcel.

In addition to land parcels, the location of the roadway and any other significant roads in the vicinity of the project should be identified. Other items to be included are project limits, property lines, section lines, section numbers, township and range labels, and a north arrow. An example of a completed LOCO map is shown in Figure VI-1.

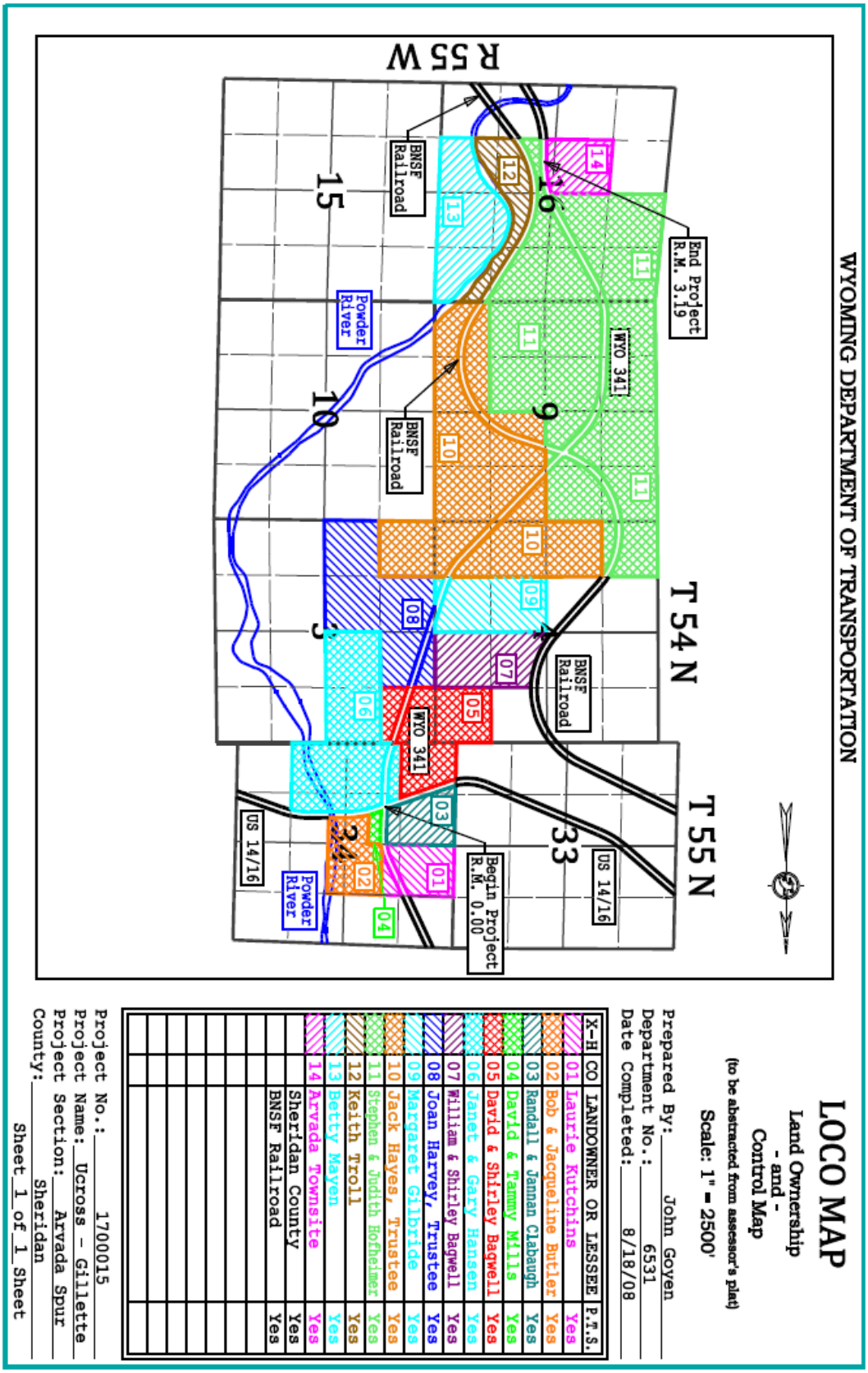

Figure VI-1. LOCO map.

b. Permission to Survey

As of July 1, 2015, Wyoming Statute 6-3-414 "Trespassing to unlawfully collect resource data; unlawful collection of resource data." has been enacted. In essence, this statute states that a person is guilty of trespassing to collect data if they do not have an ownership interest in the property or other legal authorization to enter or access the land; or have written or verbal permission of the owner, lessee or agent of the owner.

If found guilty of trespassing to unlawfully collect data they may be punished by imprisonment for not more than one year and/or a fine of not more than one thousand dollars. In addition, any resource data collected in violation of this statute shall not be used in any way.

If the person has previously been convicted of trespassing to unlawfully collect resource data, then they may be punishable by imprisonment for not less than 10 days nor more than one year and/or a fine of not more than five thousand dollars.

Written permission from each land owner, lease holder, or their representative is required before a parcel may be entered. WYDOT Form E-48, Permit to Survey, is used for this purpose. A sample Permit to Survey form is shown in Figure VI-2. The Permit to Survey is a legal document and must be approved by the State's Attorney General. Therefore, alterations to the form without prior approval will not be allowed. Contact the State Photogrammetry & Surveys Engineer for a copy of Form E-48.

Frequently, obtaining permission to survey for every parcel is a time consuming process. Many land owners are not listed in the telephone book, do not live at the property in question, or are otherwise difficult to contact. For these reasons, the permission to survey activity should start well in advance of the scheduled survey operations. A signed Permit to Survey form is project specific and is valid for a limited amount of time. Surveying activities not related to a specific project would require a separate Permit to Survey form.

The contact information gathered during the preparation of the LOCO map is used to obtain permission to survey. When possible, it is recommended that land owners or their representatives be contacted prior to mailing the Permit to Survey forms. This contact will help explain the intent of the survey and resolve specific concerns. Additional concerns or requirements of the land owner can be added in the remarks section of the Permit to Survey form. If requested, an expiration date can also be included. When a substantial amount of time passes between surveying activities, the land owner should be notified prior to any subsequent entry.

When complete, a copy of the LOCO map and Permit to Survey forms shall be submitted to the State Photogrammetry & Surveys Engineer. The LOCO map will then be distributed as specified in the survey meeting.

Form E-48
5/12

Wyoming Department of Transportation

PERMIT TO SURVEY

DATE:_____

PROJECT:_____

ROAD DESIGNATION:_____

COUNTY:_____

I_____ landowner(s) or authorized agent grant to the Wyoming Department of Transportation the right to enter upon my property for the purpose of making a highway survey, land use study, and examination of my property in conjunction with completing the above listed project. This entry involves the use of personnel, surveying equipment, passenger vehicles and trucks. Surveying operations include taking of photographs, placing of survey stakes, markers, aerial targets or other reference monuments for the purpose of completing preliminary engineering surveys.

This permission is given according to Wyoming Law and does not constitute a waiver of any right or claim I might have against the Department in the event of damage inflicted to my property as a result of the Department's entry. Entry will be made during reasonable hours and after actual notice to the undersigned of times of entry.

This permission may be revoked by me with written notification to: (Resident Engineer), Wyoming Department of Transportation, (mailing address), (city), Wyoming (zip code). Any entry for the purposes other than generally accepted survey practices, land use studies and appraisals will be individually requested by the Department.

REMARKS:

_____

_____

LANDOWNER REMARKS:

_____

_____

_____

Section _____ Township _____ Range _____

_____
Landowner Phone

_____
Landowner Phone

_____
Lessee Phone

_____
WYDOT Representative Date

Figure VI-2. Permit to Survey form.

3. Preliminary and Supplemental Survey Data

A preliminary survey consists of field collected data used to create project mapping files. Examples of preliminary survey data include but are not limited to:

- Pavement features
- Sidewalk and curb features
- Driveways and approaches
- Bridge ends, approach slabs, and retaining walls
- Guardrail and bridge rail
- pipe and box culverts
- Culvert inlet and outlet flow lines
- Ditch bottom flow lines
- Topographic ground shots and breaklines
- Overhead and underground utilities

Supplemental survey data is also added to the project mapping, but is usually requested after the photogrammetric data has been plotted. Examples of supplemental survey data include terrain measurements to fill in void areas, define streams and channels, and locate geology features. Supplemental surveys are typically requested by personnel from Project Development, Hydraulics, or Geology.

a. Collecting Survey Data

The collection of survey data is typically performed with optical total stations, digital levels, and GPS equipment. Each survey instrument is capable of specific horizontal and vertical accuracies. In addition, each feature code has defined horizontal and vertical tolerance requirements. The survey data being collected will dictate the methodology needed to achieve the accuracy requirements. Refer to Table VIII-1 located in VIII, Surveys Standards, for the horizontal and vertical accuracies of each instrument.

Preliminary and supplemental surveys will be collected with the WYDOT feature code list specified in the survey meeting report. The survey standards defined in Section VIII represent the minimum accuracy requirements concerning each feature code.

b. Editing Survey Data

Editing survey data should be performed by the personnel involved with the collection. Each survey should be plotted and carefully reviewed to identify errors and/or incomplete collections. Common collection errors involve incorrect target heights and the improper use of feature codes and/or control codes. Any necessary corrections to the data should be completed prior to the transmittal to P&S.

c. Submitting Survey Data

Preliminary and supplemental surveys included in the project mapping are first submitted to the State Photogrammetry & Surveys Engineer. Raw and edited electronic survey files may be submitted via e-mail or written to a CD and sent by regular mail. Once a survey

has been sent to P&S, the data files and correspondence are archived on a designated WYDOT server. P&S also maintains a database detailing the survey data collected for each project.

Survey data submitted to P&S must include pertinent project information. This information should include at a minimum the project name, section, number, and county. A brief description of the survey, raw and edited files, and relevant field notes should also be included. If a survey was requested by another WYDOT Program or Section, the individual who made the request should be included in the correspondence.

In certain situations, survey data may be required to be submitted in a coordinate file format. The submittal shall be accompanied by a cover letter and include the project information described above. The cover letter should be signed and sealed by a registered Land Surveyor or Professional Engineer. For more information on coordinate files, refer to Chapters 8 and 10 in the WYDOT Data Collection Manual.

4. Types of Preliminary Surveys

a. Control Surveys

Control surveys are used to establish horizontal and vertical coordinates for each monument in the project control network. Because project control monuments provide the basis for all subsequent surveys accuracy is extremely critical. The control surveys are referenced to geodetic monuments in the National Spatial Reference System (NSRS). The NSRS is a system of survey monuments maintained by the National Geodetic Service (NGS). Each monument in the NSRS is referenced to the North American Datum and the North American Vertical Datum.

The North American Datum (NAD) is the official horizontal control datum used in the United States, Canada, and Mexico. The original datum was created in 1927 and has undergone several revisions by the NGS. Recent versions include NAD 83, NAD 83 (1993), NAD 83 (CORS), NAD 83 (2007) and NAD 83 (2011). Beginning in 2012, P&S will no longer be using the NAD 83 (2007) datum. Instead, NAD 83 (2011) will be used exclusively as the primary horizontal datums to determine geodetic coordinates.

P&S uses static and rapid-static GPS collection methods for gathering the majority of the measurements to establish horizontal coordinates. Occasionally, the installation of additional control monuments becomes necessary. In these situations, conventional survey equipment and methods may be used to supplement the original control. Refer to Section V, Control Surveys, for more information on establishing coordinates for project control monuments.

The North American Vertical Datum (NAVD) is the official vertical control datum used in the United States, Canada, and Mexico. The NAVD 88 datum replaced the National Geodetic Vertical Datum of 1929 (NGVD 29). Digital level runs are used to establish vertical coordinates for the project control monuments. When possible, the levels should be constrained to NGS bench marks of 2nd order or better. If there is not an NGS benchmark near the project, then a GPS elevation will be used as a reference for the

levels. For more information on digital level collection procedures, refer to Chapter 9 in the WYDOT Data Collection Manual.

The collection of control survey data is made up of several steps. Establishing horizontal and vertical coordinates is a just one part of the process. The following is a description of each step:

(1) Monuments

Setting control monuments through the project corridor is an important step in all subsequent phases of surveying. These monuments serve as a permanent reference for preliminary, supplemental, cadastral, and construction surveys. The time elapsed from the collection of the first preliminary survey to the final construction survey could be several years. Because of this, appropriate care should be exercised when constructing each project control monument. Refer to Appendix J in this manual for an illustration of a standard WYDOT project control monument.

(2) Reconnaissance and Planning

The P&S Surveys group will complete a reconnaissance of existing monuments with published coordinates in the vicinity of the project. These monuments include NGS, USC&GS, and USGS horizontal control stations and bench marks. Previously established WYDOT project control monuments are also utilized. Typically, monuments located within the highway right-of-way are easily accessible and are the most practical. The existing survey stations are used to establish positions and elevations for the new project control. Based on the available monuments, a GPS collection plan is formulated for static and rapid-static networks.

(3) Collection

The horizontal coordinates are established by the P&S Surveys group using GPS equipment. The vertical coordinates are determined by completing level runs with a digital level. The levels are completed by personnel from the Surveys group, the Resident Engineer's office, or a consulting firm. This activity is assigned during the survey meeting. Refer to Section V, Control Surveys, in this manual for more information on GPS and digital level collections. The survey methods and equipment used must be able to meet the accuracy tolerances defined in Section VIII, Survey Standards, in this manual.

(4) Processing and Adjusting

When GPS data has been collected, the P&S Surveys group will process and adjust the raw data. The GPS observations are post-processed using the least-squares method of adjustment in the appropriate state plane zone. A datum adjustment factor (DAF) is computed for the rapid-static network to determine surface coordinates. All subsequent surveys and mapping are based on the surface coordinates.

The raw digital level data is adjusted by distance to produce elevations for each point in the level run. When the level data is processed, any parameters that have been exceeded during the collection are identified. Digital level tolerances defined in Chapter 9 of the Data Collection Manual are:

- Maximum and minimum staff readings
- Maximum distance shots
- Maximum cumulative distance balance
- Allowable misclosure

Level data that has been collected with an excessive amount of parameters tolerances that have been exceeded may need to be repeated. It is at the discretion of the State Photogrammetry & Surveys Engineer to determine whether the raw data is in compliance.

(5) Distribution

The P&S Surveys group will create and distribute a spreadsheet with the positions and elevations for each monument. The positions consist of adjusted latitudes and longitudes, state plane coordinates, and surface coordinates. The elevations include geoid separations, ellipsoid elevations, and orthometric elevations. The spreadsheet also contains the following information:

- Project name and section
- Horizontal and vertical datums
- State plane zone
- Datum adjustment factor (DAF)

A data collector file will also be created for distribution. This file is uploaded onto Trimble data collectors and used for all preliminary survey collections. Currently, the spreadsheet and data collector file are being placed in the Falcon document management system.

b. Aerial Surveys

A rural or urban mapping scale for the project is determined during the survey meeting. This scale directly affects the altitude of the photography and the flight line target intervals. Typically, the P&S Surveys group or Resident Engineer's office will be responsible for placing aerial targets. This activity will be assigned during the survey meeting.

The process of collecting aerial survey data is made up of several steps. The following is a description of each step:

(1) Locating Aerial Targets

The first step in this process is to layout the flight line targets along the length of the project at the specified interval. The targeting shall extend one full interval beyond each end of the project limits. Targets should not be placed on bridges or in areas with overhead obstructions. Individual flight line target intervals may be adjusted up to 10% to avoid these areas.

Once the flight line targets have been laid out, their approximate locations are annotated onto a photo mosaic created by the P&S Photogrammetry group. When

complete, the mosaic is returned to Photogrammetry. The wing point locations and any additional flight line targets are determined in the development of the targeting diagram. Areas where permission to survey has been denied will be plainly marked on the photo mosaic. The targets will be positioned to avoid these locations.

(2) Placing Aerial Targets

The aerial targets are placed at locations identified on the targeting diagram. The project control monuments are also targeted to provide extra photo control points. Because flights typically occur early in the day, targets should not be placed in areas where they will be covered by morning shadows. Refer to Section VII, Photogrammetric Surveys, in this manual for illustrations of flight line targets and wing points.

Before the project can be flown, latitude and longitude coordinates will need to be collected for the flight line targets. These coordinates may be collected with a hand-held GPS unit. This information is used by the Photogrammetry group to guide the mission navigation system during the flight.

(3) Obtaining Aerial Photography

The project will be flown as soon as the targets have been placed and when weather and scheduling allow. The project cannot be flown when the sun angle is too low or clouds create excessive shadows on the ground. The project also cannot be flown when windy conditions interfere with airplane navigation or when snow limits the visibility of the ground. Occasionally, due to weather or scheduling conflicts the flight does not occur when the targets have been placed. The targets should be checked prior to the flight and repainted or replaced as necessary.

Once the aerial photography has been taken, the digital images are downloaded and printed to create a colored photo mosaic. When it has been determined that the mission was a success, the aerial targets can be removed. When removing the targets, leave the wooden hub in the ground. These hubs will have coordinate values assigned and can be used in the calibration of a GPS survey. If necessary, the targets can also be replaced at the same location.

(4) Labeling Control Photos

After the project has been flown, the Photogrammetry group will create two color mosaic prints. These photos are used to annotate the project control and photo control locations. This activity is assigned during the survey meeting. The control labels should match the project and photo control naming convention described in the survey meeting report. One of the annotated copies shall then be returned to the Photogrammetry group.

(5) Collecting RTK Data

The photo control data collection will be completed shortly after the aerial targets have been laid out. This activity is typically completed by the P&S Surveys group with real-time kinematic (RTK) surveying methods. The base station is set on a project control monument while the rovers move from target to target. Each target is

collected twice from a different base station location. Digital level runs are used to establish vertical coordinates for photo targets placed within the right-of-way.

(6) Adjusting RTK Data

The RTK data is typically collected before the project control has been established; consequently the survey is based on autonomous positioning. The adjusted coordinates for the base station monuments are assigned later using proprietary software. Once the RTK data has been adjusted, the project DAF is assigned to each photo control point. Because targets outside of the right-of-way are not included in the level runs, adjusted RTK elevations are used.

(7) Processing the Photo Analytics

P&S uses an aerial triangulation software program to process photo analytics to create mapping and digital terrain models (DTM) from the photography. The program generates information used on the stereo plotter equipment used by P&S aerial mapping personnel. Refer to Section VII, Photogrammetric Surveys, in this manual more information on aerial surveys, DTM creation, and planimetric mapping.

(8) Annotating Photo Mosaic

Two sets of black and white photo mosaic prints will be created by the Photogrammetry group from the digital photography. The mosaics are used to annotate utilities, culverts, fencing, and any other features that cannot be identified on the photo mosaics. This activity will be assigned during the survey meeting.

The annotated information is used in conjunction with the field collected survey data to create the project mapping. A list of potential items to be annotated is located in Section VII, Photogrammetric Surveys, in this manual on page VII-19. When this task has been completed, the Resident Engineer's office and the Photogrammetry group will each retain one set of photos. Extra copies may be created for consultants involved in the preliminary survey process.

c. Planimetric and Topographic Surveys

Planimetric and topographic surveys collect measurements of natural and man-made features. Every surveying observation can be used to determine horizontal and vertical coordinates. However, when some of the features are mapped the vertical component is not utilized. Additionally, not all features are graphically represented in the project mapping files.

When planimetric features are mapped, they are represented by a graphical symbol, line, or shape. However, these objects do not contribute to the vertical component of the terrain model. When using the PS15 WYDOT feature code lists, planimetric features are categorize as map codes. Examples of map codes include fences, pipes, utilities, bridges, and guardrail. All planimetric data shall be collected in accordance with the accuracy tolerances defined in Section VIII, Survey Standards, in this manual.

As with the planimetric features, topographic features are typically represented by a symbol, line, or shape. However, not all of the topographic features are shown in the project mapping files. All of the topographic features will contribute to the 3-D terrain

models. These DTM's are used to create an indication of vertical relief (or elevation differences) in the form of contours. WYDOT feature code lists categorize these features as DTM codes. Examples of DTM features include pavement, ground, breaklines, retaining walls, and sidewalks. All topographic data shall be collected in accordance with the accuracy tolerances defined in Section VIII in this manual.

Refer to Chapters 4 and 5 in the Data Collection Manual for more information on WYDOT feature codes and feature code lists. The following descriptions are examples of surveys that collect both planimetric and topographic surveying features.

(1) Hydrology and Drainage Surveys

Hydrology and drainage surveys collect topographic features of waterways such as rivers, streams, and channels. This activity will be assigned during the survey meeting. Once the terrain has been collected, a 3-D representation of the area will be created. The WYDOT Hydraulics Section uses the DTM information to perform a hydraulic analysis. The amount of water a channel can carry is determined by the channel shape and will influence the structure design.

Natural drainage channels are defined by collecting drainage flow lines and breaklines. A drainage flow line is collected along the lowest part of the channel. A breakline is collected along the top of the channel on each side. Additional breaklines may be needed to properly define an irregularly shaped channel. Irrigation channels are defined by collecting drainage bottom and drainage top lines. Different codes are utilized if the ditch is earthen or concrete.

The collection area is dependent upon the scope of the project and will be determined during the survey meeting. The collection area may be collected from the aerial photography; however, these areas are normally covered with thick vegetation and a supplemental survey is usually required.

There are many other objects that should be included in a properly collected drainage survey. These features include but are not limited to headwalls, wing walls, retaining walls, erosion control features, box culverts, pipe culverts, and drop inlets.

(2) Utility Surveys

Anytime the ground is disturbed there is a possibility of a utility conflict. Consequently, accurate utility surveys are extremely important. The primary goal of a utility survey is to identify existing utility locations within the project limits. The utilities may be situated above ground and underground. The location and collection of utilities will be assigned during the survey meeting. After the utility survey has been completed, the planimetric features are included in the project mapping. Once the utilities are mapped, potential conflicts with proposed construction activities can be resolved during the design phase.

The entire length of the project should be included in the utility survey; however the width of the survey may vary. For rural projects, the utility survey should include the area within the existing right-of-way and proposed construction limits. The survey

should also include areas that may be used for borrow sources or haul roads. For urban projects, the utility survey should extend at least one half of a city block, or to the adjacent alley, on either side of the mainline.

Before the utility survey can be started, each utility must be located and flagged. The utility locate is initiated by calling One-Call of Wyoming at 1-800-849-2476. They will notify all of the utility companies in the area of the project. One-Call of Wyoming can also be contacted through their website, *www.onecallofwyoming.com*. The utility companies will then identify and mark the location of their utilities. Other utility information may be obtained from individual utility companies and city engineers.

In addition to taking the measurements necessary to map each utility, further information may also be required. Additional field notes may include but not be limited to:

- Company name or ownership of the utility
- Depth and type of buried utility
- Depth and size of underground pipelines
- Size of gas or water valves
- Size and depth of underground storage tanks
- Number and height of overhead wires
- Invert elevations at manholes, pipe inlets, and pipe outlets

Annotated photo mosaic prints can also be used as part of the utility survey. Refer to Section VII, Photogrammetric Surveys, in this manual for a list of utilities that may be annotated.

(3) Geology Surveys

Geology surveys are collected with specialized feature codes under the direction and guidance of the WYDOT Geology Program. These surveys collect unique geology features for the mapping of pits, quarries, and landslides. Most of the geology codes are planimetric features and do not contribute to the DTM.

The geology survey may be collected by personnel from the Resident Engineer's office or the P&S Surveys group. This activity will be assigned when a request is submitted to the State Photogrammetry & Surveys Engineer by the Geology Program.

(4) Wetland Surveys

Wetland surveys are administered by the WYDOT Environmental Services Program. Any questions regarding wetland surveys should be directed to Environmental Services.

(5) Land Surveys

As established by Wyoming State Statute, land surveys are required to be performed by or under the supervision of a Professional Land Surveyor (PLS). The PLS must also be registered in the State of Wyoming. During the survey meeting, a representative from the Right-of-Way Program will determine the land survey requirements for each project. The Right-of-Way Program will also determine whether this activity will be performed by a WYDOT District Land Surveyor or a consultant.

Land surveys are collected with specialized codes and should be collected separately from planimetric or topographic surveys. The land surveys are then submitted directly to the Right-of-Way Program. Consult the Right-of-Way Program for other requirements pertaining to land surveys.

(6) Railroad Surveys

A railroad survey is necessary when highway projects create a conflict with an existing railroad facility. Examples of these conflicts include but are not limited to:

- At-grade roadway and railroad crossings
- Roadway structures over a railroad
- Adjacent roadway and railroad alignments

Railroad surveys are typically collected up to 1000 ft from the roadway/railroad facility. When collecting top of rail measurements, use the *PROF* feature code. Refer to Section VIII, Survey Standards, in this manual for horizontal and vertical tolerances for railroad feature codes.

The vertical profile of each railroad track and the vertical clearance of highway structures over the tracks are critical. This information allows the designer to determine if a vertical or horizontal re-alignment of the railroad or roadway is necessary.

Before accessing railroad property, a signed Permit to Survey is required. In addition, a representative from the railroad may need to accompany the surveyors. The railroad may also require personal safety equipment (i.e. hard hat, reflective vest) be worn while on railroad property.

5. Distribution of Survey Data and Mapping Files

The P&S Surveys group is tasked with collecting, editing, and adjusting project control data. After the project control has been finalized, a project control spreadsheet and data collector control file will be released. Currently, these files are placed on the Falcon data management system for distribution. The Surveys group is also responsible for editing and adjusting preliminary and supplemental surveys sent to P&S.

The P&S Photogrammetry group is responsible for taking the aerial photography and creating digital imagery. The Photogrammetry group then uses the imagery to plot DTM and

Map features. The mapping files, planimetric maps and DTM's, are a combination of information obtained from:

- Aerial photography
- Annotated photos
- Preliminary surveys
- Supplemental surveys

When the mapping files have been completed, all pertinent WYDOT Sections or Programs are notified of their location. If consulting firms are involved in the surveying or design process, these files are made available by placing them on the WYDOT ftp web location.