

JOINT BASE ELMENDORF-RICHARDSON
STANDARD CONSTRUCTION SPECIFICATIONS

DIVISION 65
CONSTRUCTION SURVEYS

2021



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JBER STANDARD CONSTRUCTION SPECIFICATIONS

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CHANGE LOG

Item#	Reference(s)	Change
1	2021 release	No substantial changes

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SECTION 65.01 - GENERAL

Article 65.01.1 - Scope, Applicability, and Content of Specifications

The Work covered by these Specifications consists of providing all labor, supervision, equipment, supplies, material, transportation, handling and storage, and performing all operations necessary for construction field surveying, office work in support of field surveying, as-built drawing preparation, and related activities as necessary to complete new construction, modification, and/or repair of water distribution and wastewater collection facilities operated by Doyon Utilities LLC on Joint Base Elmendorf Richardson, hereafter referred to as JBER.

All Division 65 work shall be in accordance with the Plans, Special Provisions, Standard Details, and these Specifications. In the event of differences between the requirements contained in these various documents and specifications, the most stringent requirements, as determined by Doyon Utilities' Authorized Representative, shall govern.

Much of the content of this JBER Division 65 is taken from the 2009 Municipality of Anchorage Standard Specifications (MASS), but this JBER Division 65 also includes requirements not found in the 2009 MASS.

Article 65.01.2 - Safety

The Contractor is solely responsible for all construction-related safety and safety compliance, including, but not limited to: worker and jobsite safety; safety of Doyon Utilities employees and agents; safety of other JBER personnel and property; safety of the general public; safety of military operations; safety of wildlife and the environment; and, safety of the water distribution system, the wastewater collection system, and other utility safety.

Article 65.01.3 - JBER Access Privileges for Contractor Personnel

The Contractor shall provide Doyon Utilities LLC with a list of personnel, including Subcontractor personnel, requiring regular access to JBER, as well as required personnel identification as required by JBER military base security personnel, all at least 7 calendar days prior to the date that access is required. JBER access privileges for Contractor personnel are contingent on passing of background check to the satisfaction of JBER military base security personnel.

JBER access privileges for Contractor and Subcontractor personnel are revocable at the discretion of JBER military base security personnel.

Denial or revocation of JBER access privileges by JBER military base security personnel for Contractor or Subcontractor personnel shall not be grounds for extra Contractor or Subcontractor compensation.

Article 65.01.4 - Inspection, Notices, and Official Communications

Written notice of surveying shall be provided by the Contractor to Doyon Utilities LLC at least 5 calendar days prior to commencement of field surveying. The Contractor shall coordinate the work of the Surveying Subcontractor with Doyon Utilities' Authorized Representative and shall notify Doyon Utilities' Authorized Representative in person or by e-mail one calendar day before the Surveying Subcontractor mobilizes to, demobilizes from, or remobilizes to the Project.

Failure by the Contractor to provide the required notice(s) shall be grounds for issuance of a stop-work order and/or complete rejection of the work.

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The Contractor shall schedule survey work to occur on non-holiday weekdays during normal working hours of 7:30 AM to 4:00 PM to facilitate inspection by Doyon Utilities' Authorized Representative.

To be considered official and binding, all communication from and to Doyon Utilities LLC shall be in writing.

Article 65.01.5 - Submittals

The Contractor shall provide paper submittals or electronic submittals, at the option of Doyon Utilities' Authorized Representative, for review and acceptance by Doyon Utilities. Duplicate paper submittals shall be supplied in the quantities requested by Doyon Utilities' Authorized Representative. Submittals shall clearly document compliance with Contract requirements, as well as any deviations from Contract requirements, all to the satisfaction of Doyon Utilities' Authorized Representative. Any materials ordered and/or work done in advance of written acceptance of submittals by Doyon Utilities' Authorized Representative is subject to rejection.

Submittals for Doyon Utilities review and acceptance are required for the following items:

1. Submittals for all permanent materials (monument cases, etc.) at least 30 calendar days prior to ordering of materials.
2. Submittal of a copy of the current license for Surveying Subcontractor's Alaska Registered Land Surveyor in responsible charge of the work, at least 14 calendar days prior to beginning of construction survey work.
3. Submittal of copies of pre-construction "Record of Monument" forms, bearing the State District Recorder's stamp, at least 7 calendar days before commencement of any ground-disturbing construction activities.
4. Submittal of field survey notes for "Construction Centerline Layout", "Existing Ground Profile Check", and "As-Builts of Existing Improvements to be Replaced", and descriptions of any apparent discrepancies between design and surveyed locations and/or elevations revealed by these surveys, at least 7 calendar days prior to commencement of any ground-disturbing construction activities.
5. If requested, daily submittals of copies of field survey notes.
6. If requested, weekly submittals of other survey data listed in Section 65.02.
7. Submittal of copies of post-construction "Record of Monument" forms, bearing the State District Recorder's stamp, at least 7 calendar days before commencement of paving and/or seeding operations.
8. Submittal of all original field survey note books within 14 calendar days of substantial completion.
9. Submittal of the Surveying Subcontractor party chief's daily diary within 14 calendar days of substantial completion.
10. Submittal of Red-Lined Drawings within 14 calendar days of substantial completion.

Doyon Utilities' Authorized Representative reserves the right to request additional submittals for other Contractor procedures and personnel qualifications.

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Article 65.01.6 - Other Division Requirements

Except as specifically stated otherwise in the various Sections of this Division 65, the following other Divisions and Sections of these Standard Specifications are incorporated by reference into all Sections of Division 65:

- A. Storm Water Pollution Prevention, Clearing and Grubbing, Concrete and Asphalt Demolition, and Earthwork

The Contractor shall perform storm water pollution prevention, clearing and grubbing, concrete and asphalt demolition, earthwork, and related work in accordance with applicable sections of Division 20 - Earthwork.

- B. Wastewater Collection Facility Construction

The Contractor shall construct wastewater collection facilities in accordance with applicable sections of Division 50 - Wastewater Collection Systems.

- C. Water Distribution Facility Construction

The Contractor shall construct water distribution facilities in accordance with applicable sections of Division 60 - Water Distribution Systems.

- D. Surface Restoration

Unless shown otherwise on the Plans and/or Standard Details, specified otherwise in the Special Provisions, or directed otherwise by Doyon Utilities' Authorized Representative, the Contractor shall provide the following materials as required for surface restoration:

1. For restoration of concrete pavement, sidewalks, curb and gutter, etc – Class AA-3 Portland cement concrete in accordance with this Division 30 – Portland Cement Concrete, with concrete dimensions to match existing.
2. For restoration of asphalt pavement - Class E asphalt pavement, 2 inches minimum compacted thickness, in accordance with Division 40 - Asphalt Surfacing, over a 2 inches minimum compacted base of leveling course in accordance with Division 20 - Earthwork.
3. For restoration of gravel-surfaced roads, road shoulders, parking lots, etc. Leveling course gravel surfacing, 2 inches minimum compacted thickness, in accordance with Division 20 - Earthwork.
4. For restoration of vegetated surfaces or bare dirt surfaces not scheduled for other surface restoration – 4 inches minimum rolled thickness of topsoil and hydro-seeding with Schedule A seeding mix (for mowed areas) or Schedule D seeding mix (for unmowed areas) in accordance with Division 75 - Seeding, Landscaping, and Revegetation.

- E. Construction Surveying and Red-Lined Drawings

The Contractor shall provide construction surveying and maintain red-lined drawings in accordance with this Division 65. The red-lined drawings shall be up-dated weekly by the Contractor to the satisfaction of Doyon Utilities' Authorized Representative. Completed red-lined drawings shall be submitted within 14 calendar days of substantial completion, for review and acceptance by Doyon Utilities' Authorized Representative.

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F. Traffic Maintenance

The Contractor is solely responsible to provide all traffic maintenance for vehicular, non-motorized, and pedestrian traffic. All traffic maintenance shall be in accordance with the Division 70 - Miscellaneous Construction, and the Manual of Uniform Traffic Control Devices, latest edition adopted by State of Alaska, and current State amendments. For any operations involving disruption of normal traffic flow, the Contractor shall provide Traffic Control Plans for review and acceptance by Doyon Utilities' Authorized Representative. Traffic Control Plans shall be provided at least 14 calendar days prior to beginning any operations involving disruption of normal traffic flow. Acceptance of Traffic Control Plans by Doyon Utilities' Authorized Representative is required prior to any operations involving disruption of normal traffic flow.

Article 65.01.7 - Site Housekeeping and Clean-Up

Littering is strictly prohibited.

The Contractor shall clean up all construction debris as soon as possible after it is generated and store it properly in suitable containers, all to the satisfaction of Doyon Utilities' Authorized Representative. Trash shall be disposed of weekly or more often if directed by Doyon Utilities' Authorized Representative.

The entire project site shall be cleaned up of all debris and litter at the end of the project and all debris and litter shall be properly disposed of, all to the satisfaction of Doyon Utilities' Authorized Representative.

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SECTION 65.02 - CONSTRUCTION SURVEYING

Article 65.02.1 - Project Control

A. General

The Contractor shall provide a Surveying Subcontractor to perform all surveying, monumentation, staking, flagging, marking, and cross sectioning for earthwork quantity calculations. The Surveying Subcontractor shall, at all times during the project, employ an Alaska Registered Land Surveyor with current registration, who shall be in responsible charge of all survey work on the project. All personnel involved in measuring and recording survey data shall be directly employed by the Surveying Subcontractor and shall not be employed by the Contractor or any of the other Subcontractors for the duration of the Project. Failure to adhere to this specification will result in non-payment for all work affected by non-compliance.

The Surveying Subcontractor shall recover any existing project survey monuments shown on the Plans as well as any and all existing horizontal and vertical control monuments shown on recorded plats for the Project area. If necessary, the Surveying Subcontractor shall establish new horizontal and vertical control monuments to ensure the project is properly located and constructed according to the Plans, Special Provisions, and these Specifications.

In the event the Surveying Subcontractor is unable to locate any Project horizontal and/or vertical control monuments shown on the Plans, the Contractor shall notify Doyon Utilities' Authorized Representative immediately, and shall allow 7 calendar days, not including holidays, for Doyon Utilities' Authorized Representative to reestablish the missing monuments. The Contractor shall have no basis for a claim requesting additional compensation for costs incurred due to missing survey control which is shown on the Plans, unless Doyon Utilities' Authorized Representative fails to reestablish said control within 7 calendar days after written notification from the Contractor.

The Contractor shall notify Doyon Utilities' Authorized Representative immediately if a discrepancy exists between the field conditions and the Plans and/or Special Provisions. Project staking, which would be directly affected by the discrepancy, shall cease until direction is provided by Doyon Utilities' Authorized Representative. Project staking that is unaffected by the discrepancy shall continue uninterrupted.

If shown on the Plans, specified by the Special Provisions, or directed by Doyon Utilities' Authorized Representative, original survey monuments that must be removed for construction shall be saved and reset after construction. Otherwise, existing monuments that must be removed or destroyed shall be replaced with new monuments.

Any survey method not in full accordance with these survey specifications must be approved by Doyon Utilities' Authorized Representative prior to its use.

Errors or damages resulting from Contractor-provided survey work shall be corrected at Contractor expense.

B. Existing Survey Monuments

1. General

The term "monument" includes public land corners, private property corners, and public agency vertical and horizontal control monuments. If a question arises as

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to the validity of a found object being a monument, the determination shall be made by Doyon Utilities' Authorized Representative.

2. Existing Monument Search and Reference Survey

At least 14 calendar days before commencement of any ground-disturbing construction activities, the Surveying Subcontractor shall complete a pre-construction search for monuments shown on the Plans and/or on recorded plats for the Project area, and record the results of the monument search in a field survey book. The Surveying Subcontractor shall be responsible to obtain, review, and use all recorded plats for the Project area to assist in the pre-construction monument search.

Monuments that are found during the pre-construction monument search shall be reference surveyed for horizontal coordinates and elevations in accordance with procedures describe in Sub-Article 2.1 D below.

The Surveying Subcontractor's field survey book for the pre-construction existing monument search shall state which monuments were found and which were not found. The Surveying Subcontractor's field survey book shall also include all reference survey data for found monuments.

In the event the Contractor is unable to locate a monument that is shown on the Plans, the Contractor shall notify Doyon Utilities' Authorized Representative immediately. Doyon Utilities' Authorized Representative shall have 7 calendar days to reestablish a missing monument or make a determination whether the Project can be accurately staked without the missing monument.

The Surveying Subcontractor shall perform a post-construction monument search and record the results in the field survey book, after completion of all ground-disturbing activities in an area, and prior to restoration activities such as paving or seeding, which could be adversely impacted by monument replacement.

The Surveying Subcontractor shall replace any monument that was found during the pre-construction monument search but is not found during the post-construction monument search, at Contractor expense. Any monument replacement shall be completed prior to restoration activities such as paving or seeding, which could be adversely impacted by monument replacement.

3. "Record of Monument" Filing

Monuments for which a "Record of Monument" shall be filed include United States Government, State of Alaska, and Municipality of Anchorage geodetic control monuments and public lands cadastral survey monuments as well as public and private property corners.

At least 10 calendar days before commencement of any ground-disturbing construction activities, the Surveying Subcontractor shall file an official State of Alaska "Record of Monument" with the State District Recorder's Office, for each monument shown on the Plans and/or shown on recorded plats for the Project area,. A "Record of Monument" shall be submitted whether a monument is found during the pre-construction monument search or not found.

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Copies of pre-construction “Record of Monument” forms, bearing the State District Recorder’s stamp, shall be submitted to Doyon Utilities’ Authorized Representative at least 7 calendar days before commencement of any ground-disturbing construction activities.

Within one working day after completion of the post-construction monument search, the Surveying Subcontractor shall file a second official State of Alaska “Record of Monument” with the State District Recorder’s Office for each monument shown on the Plans and/or shown on recorded plats for the Project area,. A second “Record of Monument” shall be submitted whether an existing monument is found during the post-construction monument search or not found.

Copies of post-construction “Record of Monument” forms, bearing the State District Recorder’s stamp, shall be submitted to Doyon Utilities’ Authorized Representative at least 7 calendar days before commencement of paving and/or seeding operations.

C. New Survey Monuments and Monument Cases

These requirements shall apply to completely new monuments, new monuments replacing existing monuments that were not found during the pre-construction monument search, new monuments replacing existing monuments that were intentionally or unintentional removed, destroyed, or lost during construction, and new monuments referencing existing monuments that were removed during construction and cannot be replaced in their original locations.

Unless shown otherwise on the Plans, specified otherwise by the Special Provisions, or directed otherwise by Doyon Utilities’ Authorized Representative, standard new monuments shall be 2 inch diameter aluminum caps firmly attached to 5/8 inch diameter by 30 inch long iron rebar. New plastic monument caps are not allowed. Rebar shall be firmly set in the ground to the satisfaction of Doyon Utilities’ Authorized Representative.

All new monuments shall be center punched and shall bear the surveyor’s license number, the year set, and a description of the monument stamped into the cap.

All monuments in concrete surfaced, asphalt paved, or lawn areas shall be set in standard monument cases, conforming to AASHTO M105, Class 30A. The tops of cases shall be installed ½ inch below the concrete or asphalt surfaces and flush with lawn surfaces. The tops of monuments installed in cases shall be 6 inches below the tops of the cases.

New and reset monuments that are located in gravel surfaced areas or other surfaces subject to damage from road maintenance or similar activities, including but not limited to gravel shoulders, fore-slopes, and ditches, shall be installed 6 inches below the finished surface.

Should new construction prevent an existing monument from being reestablished at its original location, at least two new reference monuments shall be established. The locations of reference monuments shall be coordinated with Doyon Utilities’ Authorized Representative.

D. Accuracy Requirements and Procedures for Establishment of New Monuments, for Establishment of New Project Control, and for Reference Surveying of Existing Monuments

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1. General

The accuracy requirements below shall apply unless higher survey accuracy requirements are called out on the Plans, specified in the Special Provisions, or directed by Doyon Utilities' Authorized Representative.

2. Horizontal Control

Coordinates of all new permanent monuments, coordinates of project horizontal control points, and reference coordinates of found monuments shall all be established by traverse starting and ending at two different established horizontal control monuments, with each new permanent monument, new horizontal control point, and found monument included as an occupied point in the traverse. Radial side shots to establish coordinates for new permanent monuments, new horizontal control points, or found monuments shall not be allowed.

The maximum permissible linear error allowed in establishing horizontal control is 1:10,000.

The maximum error allowed in unadjusted angular closure in seconds of angle shall be calculated by the formula "15 times the square root of N." The term "N" signifies the number of occupied angle points in a traverse and "15" signifies 15 seconds of angle.

A minimum of two reference points shall be established to reference each new monument or new horizontal control point. Each reference point shall be visible to the other reference point. Reference points shall be placed at locations so to minimize the possibility of being disturbed during the construction period. Measurements and sketches of the reference points shall be kept in the survey field book.

3. Vertical Control

Vertical datum for all elevations of new permanent bench marks, elevations of temporary bench marks (TBMs), and reference elevations of found monuments shall originate from the Municipality of Anchorage Benchmark Network or National Geodetic Survey Vertical Level Line System.

Engineer's levels for differential leveling shall be two-pegged and adjusted as required prior to the start of a project, and at least every 10 working days thereafter. Two-peg tests shall be recorded in field survey notes.

Elevations of all new permanent bench marks, elevations of TBMs, and reference elevations of found monuments shall all be established by differential leveling loops starting and ending at two different established bench marks, with each new bench mark, new TBM, and found monument included as a turning point in a level loop. Differential leveling side shots to establish elevations of new permanent bench marks, TBMs, or found monuments shall not be allowed. Trigonometric leveling shall not be allowed in lieu of differential leveling.

All differential level loops shall have an accuracy of no less than the value computed by the equation "0.03 feet times the square root of the length of the level loop in miles". Leveling foresights and backsights shall be balanced. The maximum sighting distance shall not exceed 300 feet. All leveling loops shall be adjusted utilizing recognized standard surveying adjustment methods.

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Article 65.02.2 - Survey Records

A. Survey Field Books

Standard “Rite in the Rain” survey field books, or Doyon Utilities’ Authorized Representative accepted equal, shall be used for recording of survey field notes. Books shall only be used for one JBER project per book, and for nothing else.

Hand written field notes in a survey field book shall be required to record all manually collected survey data and to supplement all electronic data collection, to the satisfaction of Doyon Utilities’ Authorized Representative.

Notes in field survey books shall be neatly recorded as follows:

1. Notes shall be in pencil.
2. The date, weather conditions, survey crew personnel, and instruments used shall be shown at the beginning of each day's notes.
3. Notes shall be complete and reduced.
4. All manual survey measurements shall be recorded directly in field book.
5. Erasures or similar obscuring of field book information shall not be acceptable. A single line shall be drawn through those portions of the notes in error leaving the original notes legible. The correction shall be noted above the original entry. Corrections shall be initialed and dated. Where appropriate, a note of explanation shall be included.
6. Notes shall be precise and sufficiently detailed to the satisfaction of Doyon Utilities’ Authorized Representative.

If requested by Doyon Utilities’ Authorized Representative, a copy of each day's survey field book notes shall be reduced and delivered to the office of Doyon Utilities’ Authorized Representative by 12:00 Noon of the following work day.

Doyon Utilities’ Authorized Representative shall have the right to inspect and take possession of the survey field books at any time throughout the project.

All field books used for the project shall be permanently submitted to Doyon Utilities’ Authorized Representative within 14 calendar days of substantial completion. Each survey field book shall be indexed and its contents referred to by page number prior to submitting the survey field book to Doyon Utilities’ Authorized Representative. All field books shall be sealed and signed by the Surveying Subcontractor’s Alaska Registered Land Surveyor on the title page of each field book.

B. Surveying Subcontractor Party Chief's Daily Diary

The Surveying Subcontractor’s Party Chief shall keep a factual daily diary of all work performed by the survey crew on the project. As a minimum, the diary shall contain the following information:

1. Date.
2. Crew.
3. Type and location of survey work performed.
4. Work accomplished.

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5. Directions from Doyon Utilities' Authorized Representative.
6. Signature of party chief.

This diary shall be kept on the project site and submitted to Doyon Utilities' Authorized Representative upon request. At completion of the project this diary shall become the property of the Doyon Utilities.

C. Other Survey Documentation

If requested by Doyon Utilities' Authorized Representative, survey documentation listed below shall be delivered to Doyon Utilities' Authorized Representative weekly by close of business every Monday (or the following Tuesday if Monday is a holiday) for work completed during the previous week.

1. Traverse and/or level loop adjustment calculations for the previous week.
2. Coordinate calculations based on adjusted traverse angles and distances, and a listing of all adjusted coordinates calculated in the previous week for new monuments, new horizontal control points, and/or existing reference-surveyed monuments.
3. Elevation calculations based on adjusted level loops, and a listing of all adjusted elevations calculated in the previous week for new monuments, new TBMs, and/or existing reference-surveyed monuments.
4. Printouts of the unedited output from data collectors to include: point numbers, code descriptors, horizontal circle information, vertical circle information based on zenith, and slope distances expressed in feet.
5. Printouts of reduced and adjusted data for each data collector point including point number, code descriptor, station and offset left or right of centerline or coordinates, and elevation.
6. Sheets containing explanations of code descriptors used to identify the various shots.
7. All cross section data in unedited points files so it can be independently verified by Doyon Utilities' Authorized Representative.
8. CAD drawings, showing occupied control points, control points used for horizontal back sights, bench marks or TBMs used for vertical control, and points surveyed from each occupied control point, including point numbers, coordinates, and elevations for all points.
9. CAD cross section drawings of each cross-section showing the following information:
 - a. Centerline or control line and station.
 - b. Design grade template with superimposed before- and after-excavation surfaces.
 - c. Listing of usable excavation areas (if any), unsuitable excavation areas (if any), and/or fill areas (if any) for each cross-section.
10. Summary spreadsheets of usable excavation (if any), unusable excavation (if any), and/or fill (if any) from station to station, and total amount of usable excavation, unusable excavation, and/or fill expressed in cubic yards.

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D. Consequences for Failure to Submit Survey Records as Required

Doyon Utilities' Authorized Representative may issue a stop work order for surveying and construction, and/or withhold Contractor payment, if:

1. Copies of requested up-to-date survey field notes are not received daily, or are not in compliance with these Specifications.
2. The Survey Subcontractor's Party Chief's daily diary is not provided upon request, or is not up to date.
3. Other requested survey documentation listed above is not received weekly, or is not in compliance with these Specifications.

No final payment will be made to the Contractor until all survey field books, the Survey Subcontractor's Party Chief's daily diary, and all other survey documentation have been submitted to and accepted by Doyon Utilities' Authorized Representative.

Article 65.02.3 - Construction Staking, Flagging, and Marking

A. Survey Subcontractor Personnel and Equipment

The Survey Subcontractor also shall employ qualified persons and shall use standard survey instruments such as electronic total stations, engineer's levels, laser devices, and GPS equipment, all in good repair and calibration, for field construction staking and layout. Personnel and equipment shall be capable of setting project control to the level of accuracy specified below. All Survey Subcontractor personnel including but not limited to the Alaska Registered Land Surveyor in responsible charge of the work and the Party Chief, all equipment, and all construction stakeout procedures shall be acceptable to Doyon Utilities' Authorized Representative.

B. Construction Surveying Prior to Commencement of Construction

The pre-construction "Existing Monument Search and Reference Survey" and "Record of Monument" filing shall be completed by the Surveying Subcontractor as described in Sub-Articles 2.1.B.2 and 2.1.B.3 above.

In addition, the following tasks shall be completed by the Surveying Subcontractor at least 10 working days prior to commencement of construction. Field survey notes, with descriptions of any apparent discrepancies between design and surveyed locations and/or elevations, shall be submitted to Doyon Utilities' Authorized Representative, at least 5 working days prior to commencement of construction.

1. Establishment of Project Horizontal Control and Temporary Bench Marks

A closed and adjusted horizontal control traverse shall be completed to establish new project horizontal control as needed. A closed and adjusted level loop shall be run to establish new TBMs for the project as needed. All new project horizontal control points and TBMs shall be to the satisfaction of Doyon Utilities' Authorized Representative.

A minimum of two permanent horizontal control points shall be utilized when establishing new project horizontal control points. New project horizontal control points shall be set at a maximum spacing of 1,000 feet. Typically, new project horizontal control points should not be more than 200 feet outside the construction limits of the project.

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A minimum of two permanent bench marks shall be utilized when establishing TBMs to verify correct elevation information. TBMs shall be set at a maximum spacing of 1,000 feet. Typically, a TBM should not be greater than 200 feet outside the construction limits of the project.

All new project horizontal control points and TBMs shall be selected and located such that their integrity will not be compromised throughout the life of the project.

2. Construction Centerline Layout

Construction centerline alignments and stationing shall be staked and checked against the design centerlines shown on the Plans.

3. Existing Ground Profile Check

Centerline existing ground profiles shall be run prior to establishment of construction grade stakes and checked against the centerline design ground profiles shown on the Plans.

4. As-Builts of Existing Improvements to be Replaced in Kind

Where existing road centerline, pavement centerline and edges, curb and gutter, curb cuts, sidewalk, driveways, ditching, retaining walls, and/or similar existing improvements are to be removed and replaced in kind without horizontal or vertical changes, and where survey information is not provided on the Plans for replacement in kind, these existing improvements shall be as-built surveyed, checked against the information that is provided on the Plans, and used for installation of replacement-in-kind facilities.

C. Resolution of Discrepancies between Design and Field Conditions

If a design location, elevation, and/or grade is/are found to be unworkable in the field, Doyon Utilities' Authorized Representative shall be notified immediately and all affected construction staking shall cease until the discrepancy is resolved to the satisfaction of Doyon Utilities' Authorized Representative. Minor changes in design location, elevation, and or grade, as necessary to meet existing field conditions, shall only be made with the written consent of Doyon Utilities' Authorized Representative.

D. Tolerances for Construction Staking, Flagging, and Marking

Construction staking, flagging, and marking tolerances shall be such that the work can be constructed to the lines, grades, elevations, and limits as shown on the Plans or Standard Details, as called out in the Special Provisions, and/or as directed from Doyon Utilities' Authorized Representative, and to meet the clear intent of Plans or Standard Details, the Special Provisions, and/or directions from Doyon Utilities' Authorized Representative. Construction errors resulting from faulty construction staking, flagging, and/or marking shall be corrected to the satisfaction of Doyon Utilities' Authorized Representative at Contractor expense. Examples of such construction errors include, but are not limited to, the following:

1. Clearing and grubbing, concrete structure demolition, or asphalt pavement demolition that either extends beyond the authorized limits or does not extend to the authorized limits.
2. Gravity sewer system piping as-built profile that has a flatter-than-minimum slope(s), reverse slope(s), and/or sag(s).

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3. Inadequate vertical or horizontal separation between water distribution and wastewater collection and/or storm drain facilities.
 4. Inadequate earth cover over water distribution and/or wastewater collection facilities.
 5. New pavement, curb and gutter, or ditching that does not drain completely.
 6. Conditions which, in the opinion of Doyon Utilities' Authorized Representative, result in hazards to pedestrian, non-motorized, and/or vehicular traffic.
 7. Any other construction errors resulting from faulty construction staking, flagging, and/or marking that cause the finished work to fail to meet the clear intent of the Plans or Standard Details, the Special Provisions, and/or directions from Doyon Utilities' Authorized Representative.
- E. Replacement of Lost or Destroyed Construction Control, Staking, Flagging, and/or Markings
- If construction survey horizontal control points, TBMs, staking, flagging, and/or markings are lost or destroyed for any reason, and if, in the opinion of Doyon Utilities' Authorized Representative, these construction survey items are needed to satisfactorily complete the work, construction work shall be shut down immediately and the lost or destroyed horizontal control points, TBMs, staking, flagging, and/or markings shall be replaced at Contractor expense.
- F. Staking and Flagging of Clearing and Grubbing Limits
- The Contractor shall stake the clearing and grubbing limits as shown on the Plans and/or as directed by Doyon Utilities' Authorized Representative. The staking of clearing limits shall be accepted by Doyon Utilities' Authorized Representative prior to the start of the clearing and grubbing operations.
- Distances shall be measured to the nearest foot and standard lath and flagging shall be placed to clearly designate the intended limits. Intervals for placement of lath and flagging shall vary based on the terrain and foliage density, with a minimum of 25 feet and no greater than 100 feet between lath and flagging. In areas of heavy timber, clearing stakes shall be placed to avoid leaving trees on the clearing line.
- G. Marking of Concrete Structure and Asphalt Pavement Demolition Limits
- Concrete structures shall include curbs and gutters, valley gutters, sidewalks, pavement, retaining walls, and other similar structures. Prior to concrete removal, the Contractor shall survey, mark, and offset reference mark the concrete removal limits as shown on the Plans and/or as directed by Doyon Utilities' Authorized Representative.
- Prior to asphalt pavement removal, the Contractor shall survey, mark, and offset reference mark the asphalt removal limits as shown on the Plans and/ or as directed by Doyon Utilities' Authorized Representative. Initially, pavement shall be marked for removal one foot inside of the final removal limits. Immediately prior to repaving, pavement shall be remarked for removal at final removal limits.
- H. Wastewater Collection System Staking
- One centerline hub, one 90° offset hub and tack, and one 90° backsight lath shall be set at even 50 foot stations in tangent gravity sewer main, gravity sewer service, and force main sections, and at even 25 foot stations in curved force main sections. One

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centerline hub, one 90° offset hub and tack, and one 90° backsight lath shall be set for each gravity sewer manhole, gravity sewer main drop connection, gravity sewer main cleanout 45° bend, gravity sewer service connection to a main or manhole, gravity sewer service bend, gravity sewer service cleanout wye, gravity sewer service building connection, force main connection to a main or manhole, force main bend, force main point of curvature, force main point of tangency, and grade break in a force main profile.

Guard laths shall be provided for each 90° offset hub and shall display the following information as appropriate:

1. Station.
2. The horizontal distance from the reference tack to the center of piping.
3. The amount of cut or fill from the top of the offset hub to pipe invert.
4. Size and description of the manhole or clean-out.
5. The horizontal distance from the reference tack to the center of the manhole or clean-out.
6. The amount of cut or fill from the top of the offset hub to the rim of the manhole and pipe inverts in the manhole.
7. The amount of cut or fill from the top of the offset hub to the pipe invert at a clean-out 45° bend or wye.
8. Size, description of piping, and orientation as appropriate (for instance, “4” SERVICE CONNECTION RIGHT”).

I. Water Distribution System Staking

One centerline hub, one 90° offset hub and tack, and one 90° backsight lath shall be set at even 50 foot stations in tangent water line sections and at even 25 foot stations in curved water line sections. One centerline hub, one 90° offset hub and tack, and one 90° backsight lath shall be set for each tie-in point, bend, tee, cross, valve, hydrant, water service, point of curvature, point of tangency, and grade break in water line alignments.

Guard laths shall be provided for each offset hub and shall display the following information as appropriate:

1. Station.
2. The horizontal distance from the reference tack to the center of piping.
3. The amount of cut or fill from the top of the offset hub to pipe invert.
4. Size, description of piping, and orientation as appropriate (for instance, “12” x 8” TEE, BRANCH LEFT”).

J. Staking for Street and Road Subgrade, Base Course, and Paving

Slope stakes shall be provided as necessary to locate cut or fill catch points with existing grade. Slope stakes shall be set at even 50 foot stations in tangent street sections, at even 25 foot stations in horizontal and vertical curves, at points of horizontal curvature and tangency, at additional stations as necessary to provide accurate lay out in super-elevated horizontal curves, at profile grade breaks, at beginnings and ends of vertical curves, and at high or low points in vertical curves.

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Centerline, right shoulder, and left shoulder hubs, at least one 90° offset hub and tack, and one 90° backsight lath for each offset hub for excavation and grading of the street or road subgrade shall be set at even 50 foot stations in tangent street sections, at even 25 foot stations in horizontal and vertical curves, at points of horizontal curvature and tangency, at additional stations as necessary to provide accurate lay out in super-elevated horizontal curves, at profile grade breaks, at beginnings and ends of vertical curves, and at high or low points in vertical curves.

Guard laths shall be provided for each offset hub and shall display the following information as appropriate:

1. Station.
2. The horizontal distance from the reference tack to centerline, right shoulder, right ditch bottom, left shoulder, and left ditch bottom.
3. The amount of cut or fill from the top of the offset hub to subgrade at centerline, right shoulder, right ditch bottom, left shoulder, and left ditch bottom.

Centerline, right shoulder, and left shoulder hubs shall be topped with colored plastic whisksers. Centerline, right shoulder, and left shoulder hubs shall be replaced if disturbed or destroyed prior to placement or grading of base course.

Offset hubs and tacks shall be provided at the radius points of returns at all side street, side road, and driveway intersections. Guard laths shall be provided for each offset hub and shall provide the radius to the shoulder line, and the radius to edge of pavement at locations where curb and gutter will not be installed.

Offset hubs for subgrade shall be protected or replaced if necessary for use in placement of pavement base course and for paving in locations where curb and gutter will not be installed.

A second set of new guard laths shall be provided for each offset hub for base course placement and shall display the following information:

4. Station.
5. The horizontal distance from the reference tack to centerline, right shoulder, and left shoulder.
6. The amount of cut or fill from the top of the offset hub to base course at centerline, right shoulder, and left shoulder.

A third set of new guard laths shall be provided for each offset hub for paving in locations where curb and gutter will not be installed, and shall display the following information:

7. Station.
8. The horizontal distance from the reference tack to centerline and right and left edges of pavement.

K. Culvert Staking

One centerline hub and one offset hub and tack shall be set for each end of each culvert. Offset hubs and tacks for culvert installation shall be set on the extended centerline of the culvert.

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Guard laths shall be provided for each offset hub and shall display the following information:

1. Station.
2. Size, length and type of culvert.
3. The horizontal distance from the reference tack to the end of the culvert.
4. The amount of cut or fill from the top of the offset hub to the culvert flow line.

L. Street Curb, Gutter, and Sidewalk Staking

One offset hub and tack shall be set at 3 feet behind the top back of curb at even 50 foot stations in tangent street and road sections, at even 25 foot stations in horizontal and vertical curves, at points of horizontal curvature and tangency, at the beginnings, mid-points, and ends of side street and driveway return radiuses, at profile grade breaks, at beginnings and ends of vertical curves, and at high or low points in vertical curves.

Guard laths shall be provided for each offset hub and shall display the following information:

1. Station.
2. The horizontal offset distance from the tack to top back of curb.
3. The amount of cut or fill from the top of the offset hub to top back of curb.

Sidewalks and valley gutters shall be staked and referenced to the satisfaction of Doyon Utilities' Authorized Representative.

M. Staking for Subgrade, Base Course, and Paving for Parking Lots, Etc.

For parking lots and similar areas, subgrade hubs topped with colored plastic whiskers shall be installed at all points where the Plans provide coordinates and elevations. Offset hubs and tacks shall be provided as appropriate to assure proper placement and grading of the subgrade and base course, and to properly control paving, all to the satisfaction of Doyon Utilities' Authorized Representative.

N. Staking for Curb, Gutter, and Sidewalk for Parking Lots, for Separated Sidewalks, etc.

For curb, gutter, and sidewalk in parking lots and similar areas, and for sidewalks completely separate from curb and gutter, offset hubs, tacks, and guard lath shall be provided as appropriate to assure proper horizontal and vertical control for curb and gutter and/or sidewalk. Staking for curb and gutter in parking lots and similar areas, and for sidewalk adjacent to or separated from curb and gutter, shall be to the satisfaction of Doyon Utilities' Authorized Representative.

O. Slope Staking

Slope stakes shall be set at even 50 foot stations in tangent street sections, at even 25 foot stations in horizontal and vertical curves, at points of horizontal curvature and tangency, at additional stations as necessary for super-elevated horizontal curves, at profile grade breaks, at beginnings and ends of vertical curves, at high or low points in vertical curves, and at all cross-section stations. Slope stakes shall be set at points where the cut or fill slopes intersect the surface of original ground. Slope stakes shall display the following information:

1. Station and offset from centerline to the slope stake.

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2. Description of the cut or fill surface being staked (for instance, “TOP OF SBGRADE”).
3. Distance from the catch point to the slope stake.
4. Percent of slope of the cut or fill.
5. Amount of cut or fill.

The use of hand levels for setting slope stakes shall be limited to one turning point up or down from the instrument to the catch point. Hand level turning points shall be clearly noted in the field book.

A reference stake shall be set for each slope stake. The reference stake shall be set a minimum of 10 feet and a maximum of 15 feet beyond the slope stake. The reference stake shall re-state the slope stake information in the event the slope stake is disturbed or destroyed. A hub shall be driven flush with the ground at the reference stake and all elevations and distances referenced to the hub.

P. Miscellaneous Construction Staking

Staking, flagging, and/or marking shall be provided to the satisfaction of Doyon Utilities' Authorized Representative for adequate control of all structures and incidental construction not specifically covered above.

Q. Cross-Sectioning

1. General

The Surveying Subcontractor shall perform all cross sections necessary for determination of excavation and fill or backfill quantities, including original ground cross-sectioning, intermediate cross-sectioning, or finished grade cross-sectioning. Original ground cross sections shall be required before excavation activity. When clearing and grubbing work is included in the Project, the original ground cross sections shall be taken immediately after grubbing work is complete. Field survey notes shall indicate whether the cross-sectioning is original ground cross-sectioning, intermediate cross-sectioning, or finished grade cross-sectioning.

When both usable and unusable excavation are a part of the Project, the limits of usable and unusable materials shall be clearly identified in the cross sections in survey field books.

Cross-sectioning of usable excavation, unusable excavation, and/or fill shall be to the satisfaction of Doyon Utilities' Authorized Representative so that quantities of usable excavation, unusable excavation, and fill can be accurately computed. Failure to adequately complete cross-sectioning to the satisfaction of Doyon Utilities' Authorized Representative shall be justification for denial of payment for cut and fill work.

2. Notification Prior to Cross-Sectioning

The Contractor shall notify Doyon Utilities' Authorized Representative at least 24 hours prior to conducting any cross-sectioning. The Contractor shall obtain approval of the cut and/or fill work from Doyon Utilities' Authorized Representative prior to cross-sectioning and shall provide Doyon Utilities' Authorized Representative the opportunity to be present during the survey.

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Cross-sectioning done without notification and concurrence of Doyon Utilities' Authorized Representative, or covering of any cut or fill work before proper cross-sectioning is completed, shall be justification for denial of payment for cut and fill work.

3. Cross-Sectioning Equipment

Cross sections may be accomplished with a self-leveling engineer's level, electronic laser level, electronic total station, or GPS, supplemented with other standard survey equipment as necessary. Radial survey methods shall not be employed without prior approval from Doyon Utilities' Authorized Representative. If radial methods or trigonometric leveling methods are permitted, the survey results shall meet or exceed the minimum accuracy standards required by this Specification.

4. Procedure and Accuracy

When an engineering level, an electronic laser level, or GPS is used, cross sections shall be taken perpendicular to the centerline along tangents and on radial lines along curves. As a minimum, a right angle prism shall be used to determine perpendiculars. The heights of the instruments shall be recorded to the nearest 0.01 foot. All cross sectioning work shall be part of a closed level loop.

If only one TBM is included in the level loop, the level set-up shall be broken and a different instrument height obtained before closing into the same TBM. The maximum allowable error for level loops used for cross sectioning shall be 0.03 foot. Cross section vertical and horizontal measurements shall be accurate to and recorded to the nearest 0.1 foot. Cross-sectioning that does not meet accuracy standards to the satisfaction of Doyon Utilities' Authorized Representative shall be justification for denial of payment for cut and fill work.

5. Original Ground Cross-Sections

When clearing and grubbing work is included in the Project, the original ground cross sections shall be taken immediately after grubbing work is complete.

Cross sections of original ground shall be taken at even 50 foot stations in tangent sections, at even 25 foot stations in horizontal and vertical curves, at points of horizontal curvature and tangency, at profile grade breaks, at beginnings and ends of vertical curves, at high or low points in vertical curves, and at additional locations as directed by Doyon Utilities' Authorized Representative. All cross-sections shall be perpendicular to centerline and shall extend right and left from centerline. Each cross-section shall include the following points as applicable:

- a. Centerline.
- b. Shoulders of roads.
- c. Centerlines of ditches.
- d. Toes of slopes.
- e. Tops of slopes.
- f. Grade breaks.

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- g. Other physical features within the cross-section limits that affect excavation and/or fill quantities.
- h. Right and left catch points.
- i. Ground shots at least 10 feet beyond right and left catch points.

In areas where overbreak or slides are anticipated, sections shall be extended out from centerline to include the anticipated disturbed ground area.

6. Intermediate Cross-Sections of Usable and Unusable Excavation

Intermediate cross-sections shall be taken at the same stations and cross-section points as the original ground cross sections, with additional cross-section points as necessary to calculate usable and unusable excavation volumes to the satisfaction of Doyon Utilities' Authorized Representative.

7. Finished Grade Cross-Sections

Finished grade cross-sections shall be taken at the same stations and cross-section points as the original ground cross sections.

Article 65.02.4 - Red-Lined Drawings

A. General

As-built survey measurements shall be required for all constructed facilities and improvements to confirm the dimensions, lines, grades, elevations, locations, and/or materials as shown on the Plans. Survey measurements shall be taken, field notes shall be kept, and accuracy shall be attained in accordance with this Division. As-built information shall be marked in red on a clean set of 24" by 36" issued-for-construction paper plans clearly marked "Red-Lined Drawings". The Red-Lined Drawings shall be up-dated weekly by the Contractor to the satisfaction of Doyon Utilities' Authorized Representative.

The Red-Lined Drawings shall be submitted to Doyon Utilities' Authorized Representative within 14 days of substantial completion. No final project payment will be made to the Contractor until the Red-Lined Drawings have been submitted to and accepted by Doyon Utilities' Authorized Representative.

B. Requirements for Red-Lined Drawings:

- 1. As-built changes shall be marked in red to clearly identify the changes to the original design.
- 2. Changed stationing, elevations, and/or notes shall be crossed out with single lines, with the as-built values and/or modified notation shown in red directly above, below, or beside the crossed-out information.
- 3. Pre-existing utility lines or any construction that has been deleted or relocated shall be neatly crossed out. Crossed-out information shall still remain legible.
- 4. All existing utilities, including as-built stations and elevations, shall be shown on red-lined drawings.
- 5. Reference information used to prepare red-lined drawings such as change orders and field books shall be referenced on the Plans.

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6. Profile changes will be made with elevations or stationing only. The profile line need not be re-drawn unless directed by Doyon Utilities' Authorized Representative.
7. Red-lined drawings for water, sewer, gas lines, and storm drain systems shall be accurate within 0.03 feet vertically and 0.5 feet horizontally. As-built Information shall be referenced to centerline.
8. Red-lined drawings for structures shall be accurate to within 0.04 feet vertically and horizontally.
9. All as-built GPS coordinates called out in other Divisions shall be provided on the red-lined drawings in a format acceptable to Doyon Utilities' Authorized Representative.
10. The name and signature of the red-lined drawings preparer, the name of the Contractor, and the date of the preparation shall appear in the appropriate revision block on each red-line drawing sheet.