
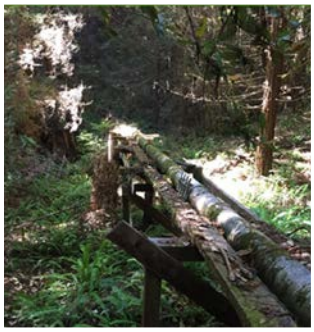

Raw Water Line Replacement Project

City Project No.: 2018-02

PROJECT EXISTING CONDITIONS AND CONSTRAINTS

COLEMAN ENGINEERING

July 18, 2019

City of Fort Bragg
Raw Water Line Replacement Project
City Project No. 2018-02

TECHNICAL MEMORANDUM: PROJECT EXISTING CONDITIONS AND CONSTRAINTS

Prepared by:

COLEMAN ENGINEERING

Project #: FTBG18-001

July 18, 2019

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1 PROJECT BACKGROUND AND DESCRIPTION

1.1 General

The City of Fort Bragg's Water Treatment Plant (WTP) at the intersection of Sherwood Road and Monsen Way receives its raw water supply from three sources via two pipelines. For the first source, raw water from the Madsen Hole on the Noyo River to the east of the WTP is pumped via 10-inch and 14-inch dia. pipe directly to the WTP. This pipeline is not included in this project. The second and third sources of supply are from two raw water sources at Waterfall Gulch and Newman Gulch to the south of the WTP. Water from both sources is conveyed in a single connecting pipeline under pressure to the WTP. The pipeline is a combination of 6, 8, 10 and 12-inch dia. PVC, asbestos cement, ductile iron and steel pipe. It crosses a variety of terrain, including City subdivisions, but significant lengths are in steep, heavily-wooded and landslip-prone gorges that are difficult to access. Sections of the pipeline are also characterized by shallow groundwater, springs, and sensitive riparian environments, with part included within the Coastal Zone. There are crossings of the Noyo River and Hare Creek/Covington Gulch. The elevation at the pipeline's highest point is approximately 335 feet above sea level (Waterfall Gulch intake), while the low point in the profile is at the Noyo River crossing just above sea level.

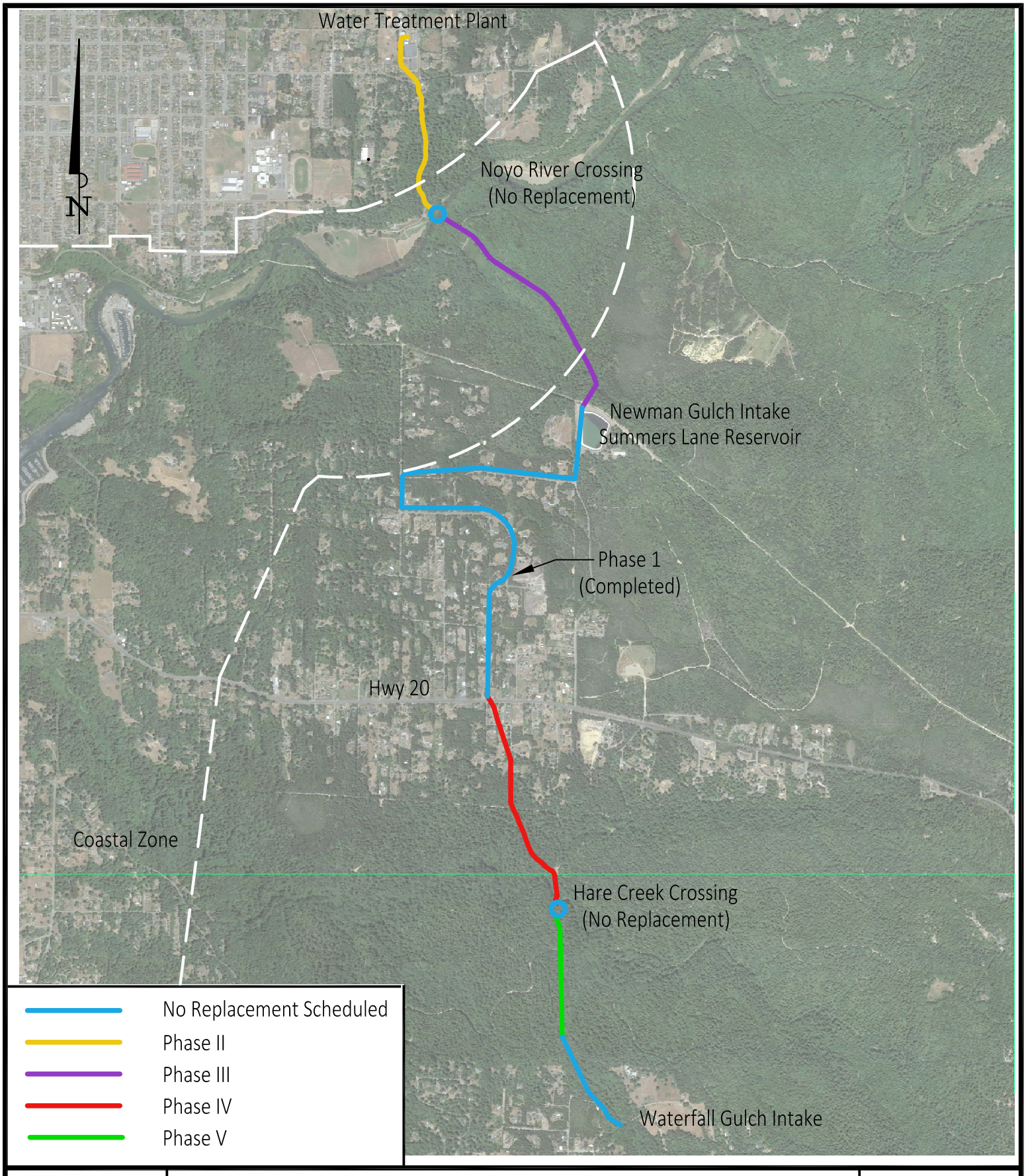
Novo River Crossing

Sections of this transmission pipe are reaching the end of their service life and pipe failures are becoming more regular and widespread. Portions of the pipeline are partially buried with the pipe crown exposed, while one section is above ground and supported on a deteriorating wooden trestle. As a result, there is a threat to the reliability of a significant portion of the City's water supply. This project is for the replacement of these sections of pipeline to increase that reliability and provide more resilience to the raw water supply system.

This Raw Water Replacement Pipeline Project has been divided into five phases to facilitate implementation, as shown on Figure 1 and detailed below in Table 1. Phase I from the northside of Highway 20 to the Summers Lane Reservoir was constructed in 2013 and is not included in this stage of project implementation. Similarly, the Noyo River and Hare Creek / Covington Gulch crossings, and the section of pipeline from the Waterfall Gulch Intake to Road 450 were constructed relatively recently and replacement is not considered necessary at this time.

Table 1: Raw Water Replacement Project Phases

Phase	Location	Approx. Length, feet	Existing Pipe Dia., Inches	Description of Existing Pipeline Route and Terrain
I	Highway 20 (N) to Summers Lane Reservoir / Newman Gulch Intake	7,000	10	Completed in 2013. No further implementation required.
II	Noyo River Crossing (N) to WTP	3,150	12	Pipeline in slope bench in a heavily-wooded, steep, unstable gorge prone to landslide and slope creep. Previous slope failures and loss of pipeline. Part in Noyo River floodplain and Coastal Zone.
III	Summers Lane Reservoir / Newman Gulch Intake to Noyo River Crossing (S)	3,800	10	Pipeline runs generally across-slope, located at the top of the Newman Gulch gorge eastern slope in very heavily-wooded, inaccessible terrain. Part in the Noyo River floodplain. Most of the alignment is in the Coastal Zone.



COLEMAN ENGINEERING

FIGURE 1: OVERVIEW MAP
RAW WATER PIPELINE REPLACEMENT DESIGN
CITY OF FORT BRAGG

COLEMAN ENGINEERING
1358 Blue Oaks Boulevard, Suite 200, Roseville California (916) 791-1188

DATE: 7/15/2019
DRN: MS
CKD: SNG
SCALE: 1"=2000'
JN: FTBG18-001

Phase	Location	Approx. Length, feet	Existing Pipe Dia., Inches	Description of Existing Pipeline Route and Terrain
IV	Hare Creek Crossing (N) to Highway 20 (N)	3,100	6 & 10	Replacement will include a new crossing of Highway 20. In residential sub-division between Highway 20 and an east-west forest road at the south end of Porterfield Lane. Heavily-wooded, steep downslope from the forest road to the Hare Creek Crossing.
V	Road 450 to Hare Creek Crossing (S)	1,050	6 & 10	Wooded terrain from Road 450, with steep downslope to the Hare Creek Crossing. Wooden trestle support for above ground pipeline north of Road 450.

1.2 Existing Ground Profile, Flows and Hydraulic System

Figures 2 and 3 show the approximate ground profile along the existing pipeline route. The existing transmission main operates as two sections of gravity pressure pipeline, with a hydraulic break at the Summers Lane Reservoir:

- Waterfall Gulch to Summers Lane Reservoir (includes Phases I, IV and V)
- Summers Lane Reservoir to WTP (includes Phases II and III)

Approximate maximum static pressures in the existing pipelines, by phase, are given below in Table 2:

Table 2: Approximate Maximum Static Pressures by Phase

Phase	Approximate max. static pressure (psi)	Location of max. pressure
II, III	140	Adjacent to Noyo River Crossing
IV, V	140	Adjacent to Hare Creek Crossing

The flow rate for the existing raw water pipeline is limited by the water right at Waterfall Gulch. According to information provided by the City, the Waterfall Gulch Appropriate Water Right is limited to a Maximum Annual Diversion of 475 acre-feet per year at a maximum rate of 0.668 cubic feet per second (cfs). This equates to approximately 300 gallons per minute (gpm). We understand that the State of

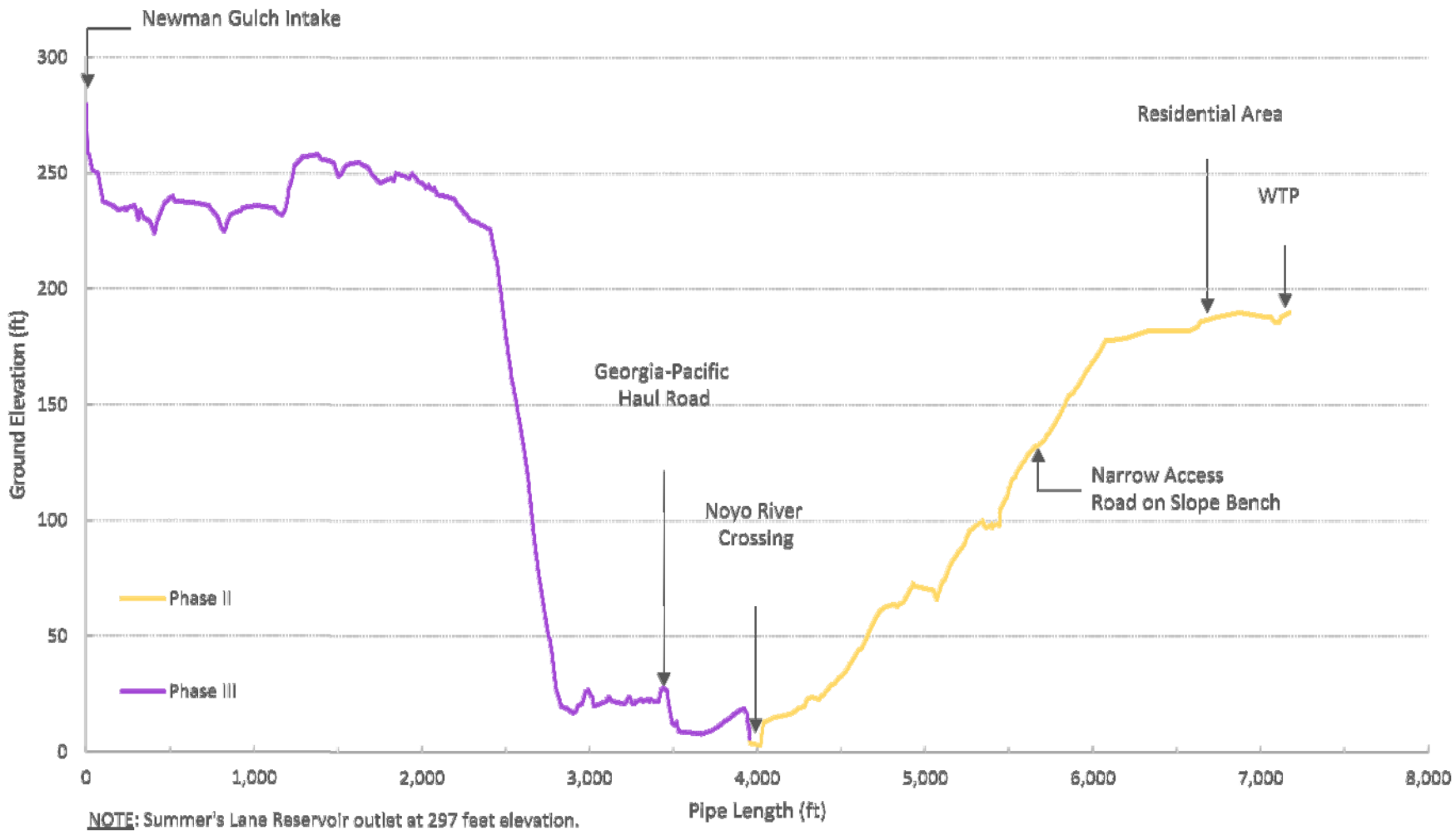


FIGURE 2: GROUND ELEVATION PROFILE OF PHASE II & PHASE III EXISTING PIPELINES

RAW WATER PIPELINE REPLACEMENT DESIGN

CITY OF FORT BRAGG

COLEMAN ENGINEERING
1358 Blue Oaks Boulevard, Suite 200, Roseville California (916) 791-1188

DATE: 7/15/2019
DRAWN: MS
CHECKED: SNG
JOB #: FTBG18-001

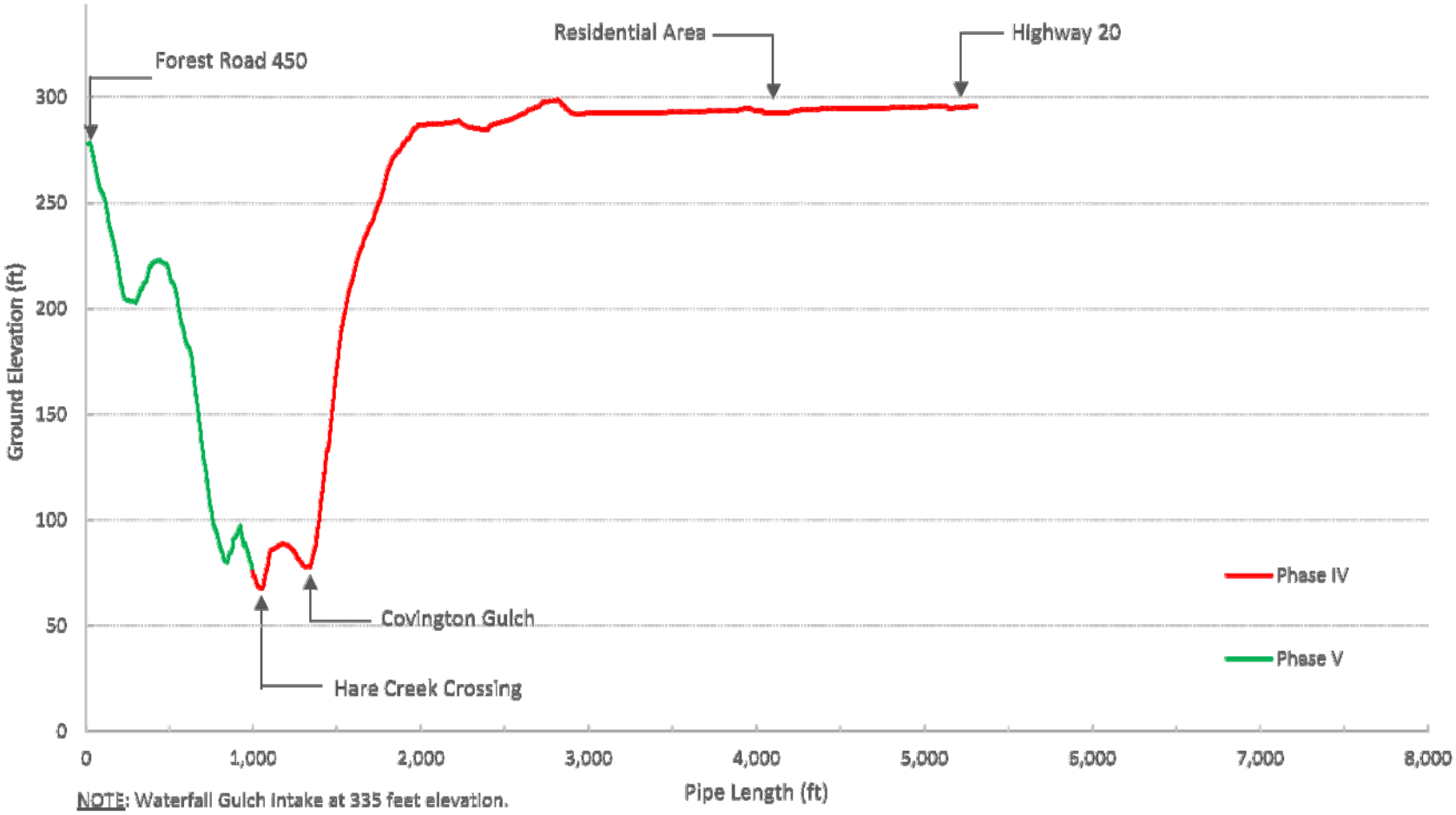


FIGURE 3: GROUND ELEVATION PROFILE OF PHASE IV & PHASE V EXISTING PIPELINES

RAW WATER PIPELINE REPLACEMENT DESIGN

CITY OF FORT BRAGG

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California Department of Fish and Wildlife desires a reduction of the maximum diversion by up to 25%, but that number is currently in dispute by the City. So, while it may be possible for this flow and thus the future design flow for the replacement pipeline to be reduced, it seems unlikely that it would ever be increased. The design flow for the replacement pipeline will thus be set at 300 gpm.

2 SCOPE AND PURPOSE OF THE TECHNICAL MEMORANDUM

This technical memorandum (TM) reviews the pipeline's existing conditions and describes the constraints on its replacement. This includes a review of existing pipe data, information and records made available by the City. The TM also documents the findings of a full-day site reconnaissance walk undertaken by the Coleman Engineering team and City staff. The reconnaissance walk and its findings are detailed below: the site walk was initiated so that key technical issues such as geologic and geotechnical hazards, access constraints, environmental issues, need for tree removal, constructability and applicable construction methods by phase could be identified in the field, examined and then discussed across the full project team. The site walk included not only the existing pipeline corridor, but also portions of other potential alternative alignments.

Using the data received and the findings of the site reconnaissance walk, a series of alternative alignments by phase are presented at the end of this TM. These alignments are defined on topographical base maps created from LiDAR data files generated from aerial mapping in May and June 2019. The City team has provided input on these potential alignments and their comments have been included in the maps presented later in the TM. These alternative alignments will be carried forward to a two-stage evaluation in later project tasks. This evaluation will consist of an initial 'fatal flaw' analysis that considers factors such as environmental impacts that cannot be mitigated except by re-routing, an inability to obtain easements / right-of-way / permits, and hydraulic inadequacy. Alignments that make it through this 'fatal flaw' analysis will be subject to a detailed evaluation that also includes capital and life-cycle costs. The subsequent Project Practicality Report will describe and present the results of the evaluations, and recommend a preferred pipeline route and project for design.

3 REVIEW OF DATA AND INFORMATION RECEIVED FROM THE CITY

The City provided considerable data and information in digital form on existing pipeline design and construction, parcel information, easements, and relevant past projects at the project kick-off meeting of March 13, 2019. This data and information are listed and reviewed in the following sections:

3.1 List of City-supplied Data and Information

The following data and information were provided to the Coleman Engineering team by the City:

- Noyo River Crossing design plans by Winzler and Kelly for a 1987 project to replace the existing 10-inch dia. steel pipe crossing with a new 12-inch dia. ductile iron pipeline installed in trench (2 plans – site plan and section, and typical details). Also, construction photos at the Noyo River Crossing and location detail annotated plans for the north and south banks.
- Waterline Slope Repair Project design plans by LACO Associates for a 2003 project to re-stabilize the benched slope containing the pipeline north of the Noyo River (2 plans – erosion control plan, and plan view and sections).
- Hare Creek / Covington Gulch Crossing design plans by Winzler and Kelly for the 1990 -1 project (see below) to replace the existing 6-inch dia. asbestos cement crossing with a 10-inch dia. ductile iron pipe (single plan and profile plan with details).
- Design plans and project information for the 1990 -1 Waterfall Gulch / Simpson Pipeline Replacement Project by Winzler and Kelly. Project included replacement of the Waterfall Gulch intake structure and new buried pipeline to Forest Road 450 to eliminate existing trestles. Information includes plans, hydraulic calculations; environmental documents and correspondence with state agencies and the US Forest Service; survey data; easement documents; quitclaim deeds; record-of-survey maps; and construction phase documents.
- 1958 Jackson Pipeline location map, showing the proposed pipeline route from Newman Gulch down towards the Noyo River as it crosses Union Lumber Company property.
- Newman Bypass design plans by Winzler and Kelly for a 1990 project at the Newman Reservoir (3 plans – site plan and two miscellaneous details sheets).
- Waterfall Gulch Transmission Main – State Highway 20 to Brush Creek Road Project - as-built plans and technical specifications from 2016 for Phase I by KASL Consulting Engineers.
- Summers Lane (Newman) Reservoir Project, March 2016, including design plan set (27 plans) by Lawrence and Associates; CEQA biological assessment, Notice of Determination and Mitigated Negative Declaration documents; Timber Harvest Plan (THP) biological and botanical surveys, permits and completion report; 2007 and 2010 geotechnical reports; annotated pond plan; survey reports; technical memo on groundwater table / reservoir base separation; grading permits; and the pygmy cypress mitigation planting plan.

- Phase I Water Facilities Study – Existing Water Collection, Distribution and Capacity Report by KASL Consulting Engineers in 2012 (13 pages).
- 2018 maps and mailing lists for residents within a 300 feet radius of Phases II – V.
- Relevant easement documents from 1905, 1907, 1914, 1933, 1935, 1946 and 1961.
- Jackson quitclaim documents from 1992.
- 1968, 1977 and 2003 Record-of-Survey maps of the existing pipeline easement through the subdivision south of Sherwood Road (near the WTP)
- Record-of Survey map for the Simpson Lane Property from 1940.
- 1977 Parcel Map for the minor subdivision immediately south of Sherwood Road near the WTP.
- City-prepared summaries of easements along the pipeline routes in pdf and PowerPoint formats.
- Photos showing a landslip failure and the exposed water line on the Newman Gulch section of pipeline.

3.2 Review of City-supplied Data and Information

3.2.1 Engineering Design Information

Design and as-built project information is generally available in detail for specific locations rather than for the pipeline route as a whole. As expected, the amount and quality of available data and information improves the more recent the project. This data and information will be used in conjunction with the LiDAR-generated topographical mapping and localized traditional survey to generate the plan and profile and related detail drawings.

The 1968, 1977 and 2003 Record of Survey and Parcel Maps show the existing pipeline easement at the downstream end of the existing Phase II pipeline prior to its connection into the WTP. The easement is shown through the subdivision south of Sherwood Road but north of the wooded gorge in the middle section of Phase II. The Waterline Slope Repair Project plans from 2003 provide useful information on the existing pipeline location and the restabilized benched slope work for Phase II in the gorge section south of the Sherwood Road subdivision and north of the Noyo River Crossing. The 1987 Noyo River Crossing plans provide good details of the crossing location and potential connection points for both the Phases II and III pipelines. There is very limited design or as-built information for the existing Newman's Gulch pipeline that will be replaced under Phase III, though the 1958 Jackson Pipeline location map shows a surveyed route for the existing pipeline from the Newman Reservoir towards the Noyo River. At the head of Phase III at the Summers Lane Reservoir and the Newman's Gulch

intake, the 2016 Summers Lane Reservoir Project documents and the 1990 Newman Bypass plans provide useful as-built information for the start of the Phase III pipeline. The Summers Lane project also provides two geotechnical investigation reports.

For Phase IV, the 2016 Phase I plans and documents from the Waterfall Gulch Transmission Main – State Highway 20 to Brush Creek Road Project provide details of the existing pipeline connection point on the northside of Highway 20. There is little information on the Phase IV pipeline through the wooded areas south of the subdivision to the south of Highway 20. However, the design plans and project information for the 1990 -1 Waterfall Gulch / Simpson Pipeline Replacement Project provide details of the Hare Creek / Covington Gulch Crossings and adjacent pipelines for both Phases IV and V, and also for the existing pipeline for the Phase V route north of Road 450.

3.2.2 Easement Information

The City provided an extensive number of easement, record-of-survey, and parcel map documents for the pipeline route dating from 1905 through 2003. These were summarized by the City and are included in Appendix A of this TM. The graphics show that while there were a number of easements acquired over the lifetime of the previous and current pipelines, the existing pipeline is generally not located within the existing easements. This may be due in part to difficulty in accurately locating the old easements from their plat maps and legal descriptions, but also due to past replacement / relocation of sections of pipeline outside of the original easements. Preliminary studies by our team surveyor has shown that there may be up to 21 private properties, owned by 13 separate owners, that are crossed by the existing pipeline. Counting parcels that the pipeline crosses, or is very near to and may cross, the following parcel ownership has been identified from Mendocino County records:

- City of Fort Bragg – 2 parcels
- Wilson – 1 parcel
- Jackson State Forest – 2 parcels
- Merson Family Real Estate Partnership – 1 parcel
- Merson – 1 parcel
- Mason – 2 parcels
- Peter – 1 parcel
- Felkins – 1 parcel
- Nyren – 1 parcel

- Georgia Pacific Corporation – 1 parcel
- Lyme Redwood Timberlands – 3 parcels
- Peavey – 2 parcels
- Bates – 3 parcels

The future alignment of the pipeline may be considerably different from the existing pipeline route. This is demonstrated by the series of alternative alignments presented later in this TM that will be subject to detailed evaluation as part of this project. Once the preferred pipeline route has been selected, easement acquisition will proceed. It may be easier to negotiate a revised easement with those property owners who currently have an existing waterline easement across their property.

3.2.3 Environmental Information

Relevant environmental project documents are available for the 1990 -1 Waterfall Gulch / Simpson Pipeline Replacement Project and the 2016 Summers Lane (Newman) Reservoir Project. Generally environmental documentation needs to be less than about 5 years old in order for its findings and conclusions to be used without further study. The 1990 -1 project documents can thus only be used for reference and potential guidance for potential environmental impacts. The Summers Lane Reservoir Project documentation is recent and, although localized, is highly relevant for preparation of an Initial Study / Mitigated Negative Declaration and THP Plan for this pipeline project. The Summers Lane environmental documentation includes CEQA biological assessments, the Notice of Determination, and Initial Study / Mitigated Negative Declaration documents. The THP data and information includes biological and botanical surveys, permits, and the project completion report.

4 FULL-TEAM SITE RECONNAISSANCE WALK

4.1 Background and Purpose

A key element of the project's preliminary design studies is the full-team, one-day site reconnaissance walk. The site walk was initiated so that key technical impacts such as geologic hazards, access constraints, environmental issues, need for tree removal, constructability and applicable construction methods by phase could be identified in the field, examined and then discussed across the full project team. The walk included not only the Coleman Engineering team with its specialist subconsultants but also City public works staff and operators responsible for operation of the pipeline and the WTP. The site walk included the existing pipeline corridor and parts of other potential

alternative alignments. The intent was for each member of the team to become familiar with, and discuss, all project existing conditions and constraints including those outside of their individual specialty. Site walk attendees were:

- Diane O'Connor (Project Manager), Heath Daniels (Lead WTP Operator), and Chris Brians (WTP Operator) (City of Fort Bragg)
- Chad Coleman and Simon Gray (Coleman Engineering, Lead Designer)
- Jim Dickey (Cinquini & Passarino, Topographical Mapping and Survey)
- Aaron Smud (Alpine Summit Development, Constructability / Cost Estimating)
- Doug Brewer (Brewer Environmental, Environmental Permitting/CEQA)
- Curtis Tyler (Summit Forestry, Environmental/Timber Management)

Findings from the site walk are presented below by discipline.

4.2 Geotechnical and Geologic Conditions and Constraints

4.2.1 General Ground Conditions in the Project Area

Geology: Published geologic mapping (California Geological Survey (CGS) OFR 83-5) shows that the project area consists of Marine Terrace Deposits (generally sand with minor gravel) that are underlain by Coastal Belt Franciscan rock (well-consolidated clastic sedimentary rocks; mostly sandstone and shale). The steep side slopes along the rivers/creeks/gulches in the area generally have the Franciscan rock unit exposed at the surface.

Soils: The USDA-NRCS Soil Survey shows that project area soils are generally clayey/silty sand, with some sandy silt/clay. Soils along Hare Creek and Covington Gulch consist of clayey/silty gravel. The risk of corrosion to steel and concrete is generally rated as moderate to high throughout the project area.

Landslide Potential: Published landslide mapping data (CGS OFR 83-5) indicates that there are no landslides within the project area. However, the steep slopes adjacent to the upper part of Newman Gulch and all of Covington Gulch and Hare Creek are mapped as "inner gorge". This is a geomorphic feature formed by debris slide processes that, over time, are activated periodically by downcutting of the stream channel, and generally have slopes of 65% or greater. Vegetation is vital in order for these slope-types to maintain stability. Slope cuts have the potential to re-activate downslope movement.

Seismic Activity: The Fault Activity Map of California (2010) shows that there are no faults running through the project area. The nearest mapped fault is a pre-Quaternary-age fault that runs along Simpson Lane between Forest Road 450

and State Highway 1, about 0.8 miles southwest of the Phase V pipeline section. A Quaternary-age trace of the San Andreas Fault Zone (Shelter Cove Section) is located off-shore, about 7.5 miles from the pipeline. Both of these faults are not considered “active” per CGS. The nearest “active” fault is the San Andreas Fault Zone (North Coast Section), which is located about 20 to 25 miles south, near Manchester.

4.2.2 Phase II Pipeline Ground Conditions and Constraints

Phase II Access Road Exit onto Noyo River Floodplain

The existing raw water pipeline crosses under Sherwood Road from the south end of the WTP through private property and along a narrow, unpaved driveway. At the end of this driveway is a narrow access road (with a single chain gate) that descends down to the northern flood plain of the Noyo River. The surrounding slopes along this access road are steep and heavily vegetated, with fern undergrowth and dense tree cover. Water was observed seeping from the slopes at various locations. This is indicative of high groundwater.

Surficial soils appear to be primarily residual soils consisting of clayey sand to sandy clay. Some very intensely weathered to decomposed sandstone (breaking

down to a clayey sand and/or sandy clay with finger pressure) was observed within the slopes. A large outcrop of intact rock was observed at the bottom of the access road at the Noyo River floodplain.

City staff have advised that a large amount of stormwater runoff flows down the access road. There is a drainage ditch that runs along the western side of the road in its upper section: the drainage then twice crosses beneath the road as it progresses downslope. In addition, there is a natural drainage inflow from the northeast that combines with the drainage ditch runoff approximately halfway down the access road. Just before the drainages combine is an area of slope instability. The City has advised that this area experienced a significant slope failure in 2003 that damaged the pipeline. The slope was repaired by excavating out the failed material and replacing it with fill. There has been more recent ground movement at this location after winter storms in January and February 2017: the City has advised that this ongoing movement was first noted in March 2017.

The natural drainage channel flows right below this area of slope instability and is eroding support at the slope toe, initiating the ground movement. Additionally, the slope constituent materials are probably highly saturated in winter, based on evidence of high groundwater in the area. This only increases hydrostatic pressures and forces driving slope movement. Should the raw water replacement pipeline be routed along the access road bench, permanent slope repair will be needed, including erosion protection along the natural drainage channel and re-construction of the embankment with adequate sub-drainage.

4.2.3 Phase III Pipeline Ground Conditions and Constraints

The existing pipeline in Phase III runs from the north side of Summers Lane Reservoir, continues down to the Newman Gulch Intake and then proceeds along the eastern slopes of Newman Gulch to the Noyo River, passing under the Georgia-Pacific Haul Road. Phase III connects to Phase II on the southern side of the Noyo River Crossing.

Phase III is very comparable to Phase II with dense trees and undergrowth, water seepage, evidence of shallow ground water and sandy/clayey residual soils with decomposed sandstone in cut-slopes. The upper portion of the pipeline is aligned along the upper part of the Newman Gulch eastern slope, following a gradual but consistent descending path. The pipeline is generally located on a narrow, flat “ledge” at the top of the Newman Gulch gorge, with apparent 5 to 10-foot wide inboard cut-slopes. Some areas contain cut-slopes on either side of

the path: a through-cut. The lower portion of the existing Phase III alignment descends sharply down to the Georgia Pacific Haul Road that runs along the south side of the Noyo River, and to the Noyo River southern floodplain. During the site walk a steep slope recording of about 55% was made in this section.

Steep, Heavily-Wooded Terrain Typical of Phases III, IV and V

Leaning trees were observed throughout the Phase III area, but there was little evidence of slope stability issues. However, removal of trees and vegetation from the steep slopes during any future pipeline construction may cause slope stability issues: this would have to be evaluated as part of design. Two distinct areas of steep debris slides were also observed along the upper portion of the existing alignment, likely caused by undercutting from Newman Gulch below. One failure area had exposed the pipeline, and may have been caused by a previous pipe failure that washed out the slope. Alignment of any replacement pipeline in this area will require a setback as far as possible from these debris slide areas, due to the steepness and height of the slopes below.

4.2.4 Phase IV Pipeline Ground Conditions and Constraints

The existing water main in Phase IV is aligned from the Hare Creek Crossing, located near the confluence of Covington Gulch and Hare Creek to the northern side of Highway 20. The alignment south of Highway 20 was not examined during the site walk, but it and alternative alignments in this area proposed to run along either Dwyer and Dryer Lanes or Porterfield Lane are in a generally flat-lying, rural residential area. After passing through this residential area, the existing pipeline runs straight down the northern slopes of Covington Gulch/Hare Creek. The pipeline at the bottom of the slope is exposed before it crosses under the streams, where there is also an existing blow-off.

This area in general is similar to that of Phase II and III, with densely vegetated/forested and wet ground conditions. West of the existing pipeline alignment near Gravel Pit Road is a large outcropping of intact rock (sandstone/graywacke), with water seeping out. Some parts of the rock slopes were beyond vertical (overhanging).

The steep slopes of Hare Creek and Covington Gulch form a "inner gorge" feature. The slopes are heavily vegetated and do not show signs of recent debris slide failures. However, the removal of trees and vegetation risks destabilizing the slopes.

4.2.5 Phase V Pipeline Ground Conditions and Constraints

In Phase V, a replacement pipeline is required between Forest Road 450 (where it would connect to the existing water main from the Waterfall Gulch Intake) to the Hare Creek Crossing. There is an initial steep slope down from the Forest Road until an above-ground pipe trestle section is reached. The ground then slopes relatively gently until reaching the southern Hare Creek slopes, which descend steeply down to the creek. The area in general is similar to the other phases: densely vegetated and forested with wet ground conditions.

The pipeline is exposed at numerous locations: these appear to be either potholes for repairs or caused by erosion. The trench backfill in general sags relative to the surrounding ground. During the site walk it was found that at one location a tree had fallen on an-above ground portion of the pipe. A small ponding of water was observed within a depression about 50 feet from the pipe alignment just downstream of the pipe trestle section.

The steep southern slopes of Hare Creek are very similar to the northern slopes (densely vegetated, “inner gorge” slopes with no sign of recent debris slides).

Phase V Trestle

4.3 Environmental Conditions and Constraints

4.3.1 General Environmental Conditions in the Project Area

The project is situated in the Noyo River redwood forest watershed, which has abundant natural resources supporting numerous special status species that are protected under state or federal regulation, including the Coastal Tailed Frog, Red-legged Frogs, Pygmy cypress trees, and the Southern Torrent Salamander. The Noyo River and Hare Creek also support Coho salmon and steelhead. Under a separate task for this project, environmental records research and detailed biological surveys are being used to assess existing habitats and to determine whether the project area supports these species. The findings from these surveys will assist in determining whether a particular pipeline alignment has a fatal environmental flaw that would prevent its implementation, or whether a potential environmental impact can be successfully mitigated. Once a project is defined, Initial Study / Mitigated Negative Declaration documents will be prepared for compliance with the California Environmental Quality Act (CEQA).

There are potential impacts to historical and cultural resources across the project area. The project is located in an area with a local lumber industry history, as well as occupation by Native American Indian Tribes that inhabited the Fort Bragg area. There are several recognized Indian Tribes in the region, including the Noyo Pomo Tribe and the Sherwood, Coyote Valley Band of Pomo Indians.

Wetlands and Waters-of-the-United States have to be delineated and defined as part of the environmental studies for the project. While the raw replacement pipeline project will not include replacement of the existing Noyo River and Hare Creek Crossings at this time, any new pipelines will have to cross their adjacent floodplains. This triggers compliance with the federal Clean Water Act Section 404 and the California Department of Fish and Wildlife (CDFW) Fish and Game Code Section 1600 and associated permits from the US Army Corps of Engineers and CDFW.

There are Coastal Zone impacts on Phases II and III, which are partially located within the regulatory boundaries of the State Coastal Commission Coastal Zone. Permitting is administered locally through the Mendocino Coastal Zone Administrator.

The project will require the removal of secondary growth redwood, alder and other trees to allow pipeline construction, primarily in Phases III, IV and V. This triggers the need for preparation of a THP by a certified forester. This THP is being prepared under a separate task. The THP approval process is administered by the State Department of Forestry under the requirements of the Forest Practices Act and is a separate permitting process. The THP permit application will be supported by the City's project CEQA compliance document: the environmental studies are being prepared with both the requirements of CEQA and the THP permit in mind.

Initial biological studies are currently underway, and will be performed until May 2020. These fauna surveys now underway include those for the Northern Spotted Owl (NSO), raptors and ospreys. Other fauna surveys include the Southern Torrent salamander and Foothill Yellow-Legged Frog. Rare plant surveys are also currently in progress. The results of these studies will be used in the detailed evaluations of pipeline route alternatives to be presented in the Project Practicality Report. Plant and NSO / raptor surveys have had no detections of sensitive species to date (July 2019).

The above environmental conditions and constraints apply to most of the project area. The following sections describe particular local environmental and THP conditions and constraints by phase as determined on the site walk. The results of the more detailed studies and surveys will be presented in later project deliverables.

Above-Ground Ductile Iron Pipe

4.3.2 Phase II Pipeline Environmental Conditions and Constraints

For the existing Phase II water main alignment, it was noted that there may be biological herpetofauna species impacts due to the proximity to the Noyo River and its floodplain, and to the natural discharge channels adjacent to the water main access road. There are also potential impacts on salmonids in and near to the Noyo River. The permitting for this pipeline section will include Clean Water Act Section 404, CDFW Section 1600 and California Coastal Commission development permits. It was noted that as the Section 404 and Section 1600 permitting will be required for crossing the Noyo River floodplains, there may be an advantage in also including a replacement crossing in the permit application. Such a crossing would probably require horizontal direction drilling installation methods. This idea will be discussed with the City.

There are potential temporary aesthetic, noise and dust impacts associated with construction that will impact the residents in the sub-division south of the WTP and Sherwood Road.

There is likely to be no need for a THP, or an exemption will be acceptable.

4.3.3 Phase III Pipeline Environmental Conditions and Constraints

As with the Phase II alignment, there are likely to be biological herpetofauna issues near Newman Gulch, the Noyo River floodplain, and the existing pond immediately south of the Georgia Pacific Haul Road. The permitting for this pipeline section across the Noyo River floodplain will include Clean Water Act Section 404, CDFW Section 1600 and California Coastal Commission development permits. During the site walk, numerous seeps and springs were observed: these may be classified as Waters-of-the-United States and subject to additional permitting.

There are also potential historical / cultural issues in this phase with evidence of old water management structures and very old redwood pipe. These may require recordation, as the facilities are over 50 years old. Our cultural specialist will examine this issue during later environmental studies.

There is likely to be a need for a THP or a THP Exemption for any pipeline route from the Newman Gulch intake to the Noyo River.

In both biological and THP terms, it appears to be better to realign the Phase III pipeline further away from Newman Gulch, and to intercept the current alignment at the Georgia Pacific Haul Road.

4.3.4 Phases IV and V Pipeline Environmental Conditions and Constraints

The densely-vegetated and forested Phases IV and V will be subject to similar environmental issues and constraints as the downstream phases. Potential biological herpetofauna and salmonid impacts occur at, and in proximity to, Hare Creek and Covington Gulch. Clean Water Act Section 404 and CDFW Section 1600 permits will be required for the pipeline sections in the floodplains of the Covington Gulch and Hare Creek Crossings.

As with Phase III, there are potential historical / cultural issues in these phases, with evidence of old water management structures and very old redwood pipe. These may require recordation, as the facilities are over 50 years old. Our cultural specialist will again examine this issue during later environmental studies.

A THP Exemption and potentially a special use permit will be needed for any pipeline section through the Jackson State Demonstration Forest from the north end of Phase IV to the Covington Gulch and Hare Creek Crossings.

4.4 Constructability Conditions and Constraints

Our specialty constructability sub consultant attended the site walk and has made the following observations about construction conditions and constraints for each phase of the raw water replacement pipeline project.

4.4.1 Phase II Constructability Conditions and Constraints

The proposed pipeline will probably connect to the existing 10-inch dia. PVC waterline near the existing flow meter vault on the south side of the existing WTP, although there is potential to extend the new main within the WTP site to feed the existing raw water storage basins. The new pipeline would cross Sherwood Road and then follow the existing gravel / dirt road heading south and downhill to Noyo River. The proposed right-of-way (ROW) would be on a narrow, benched access road with some existing culvert crossings. Construction would require minor clearing, tree trimming and improvements to the existing access road. SWPPP and erosion control will be a major consideration for this installation to prevent sediment or other debris from entering existing drainage channels. These measures will need to be installed and maintained during and after construction. Long term revegetation of the ROW or permanent access road construction will also be needed.

Pipeline construction should allow for a traditional open-cut, direct-buried pipeline installation. A minimum 25 to 40-feet wide temporary construction easement will likely be required to string pipe, excavate the trench, store trench soils, install the pipeline, backfill and compact the trench, and restore the ROW. We anticipate that some sections of the pipeline may require restrained joints for both pipe and fittings.

Typical pipeline appurtenances such as blow-off valves and combination air release valves may be required at proposed high and low points, but this phase appears to have a consistent hydraulic profile. Mainline isolation valves may be required at a certain footage frequency to isolate sections of the pipeline. These valves will need to be protected and clearly marked with bollards or similar for future access.

The geotechnical investigations will determine whether cathodic protection systems or equipment will be required.

The existing crossing of the Noyo River is currently planned to remain in place. However, permits applicable for replacing the crossing will still have to be obtained for crossing the Noyo River floodplain. There may be advantages to the

City in replacing the crossing as part of Phases II or III. Trenchless HDD methods would likely be the most economical and constructible for this replacement. The HDD pipeline could be constructed with either HDPE, Fusible PVC or Restrained DIP depending on design considerations. The HDD drilling entry location would likely be on the north side of the river and the pullback pipe string would likely be on the south side. A hydrostatic pre-test of the HDD pipe string would be recommended to verify there are no leaks or defects prior to pullback. It appears that extensive land clearing and timber harvest may be required on the south side of the river to allow for temporary construction workspace.

4.4.2 Phase III Constructability Conditions and Constraints

The proposed Phase III pipeline would first connect to the existing waterline near the northwest side of the Summers Lane Reservoir. A short section of new pipeline would follow the existing gravel road heading north and downhill to the Newman's Gulch Intake. Construction would likely require minor clearing, tree trimming and improvements to the existing gravel access road.

Newman's Gulch Intake

There would also be a second connection to the existing Newman's Gulch Intake Pipeline at or near an existing vault. If it generally followed the existing pipeline alignment, the new pipeline would head northwest and mostly downhill towards the existing Georgia Pacific Haul Road and the Noyo River Crossing.

This section of the alignment will be traveling cross country through heavily-forested ROW with steep cross slopes and one very steep downhill section. The proposed alignment will require extensive land clearing, timber harvest, access road grading and earthwork. A minimum 25 to 40 feet wide temporary construction easement will likely be required for access road grading, pipe stringing, trench excavation, trench soil storage, pipeline installation, trench backfill and compaction, and restoration of the ROW. As with Phase II, SWPPP and erosion control will be a major consideration for this section to prevent sediment or other debris from entering Newman Gulch. These measures will need to be installed and maintained during and after construction. Long term revegetation of the ROW, or permanent access road construction, will also be needed.

Depending on environmental restrictions and allowed temporary workspace, the pipeline construction could allow for traditional open-cut direct-buried pipeline installation. Some sections of the pipeline may require restrained joints for both pipe and fittings.

Typical pipeline appurtenances such as blow-off valves and combination air release valves may be required at proposed high and low points, but as with Phase II, this phase appears to have a consistent hydraulic grade. Mainline isolation valves may be required at a certain footage frequency to isolate sections of the pipeline. These valves will need to be protected and clearly marked with bollards or similar for future access.

As with Phase II, the need for a cathodic protection system will be determined by further geotechnical investigation and testing.

Utilizing traditional or shallow HDD methods could be the most economical and constructible approach for certain sections of the pipeline if the replacement follows the general existing alignment. However, given steep slopes, unknown soil conditions and limited space to assemble long pull-back pipe strings, further investigation would be needed to determine if this is a viable alternative.

Given the environmentally sensitive ROW, and many of the restrictive conditions listed above, any method of pipeline construction in this area will be very

difficult and possibly cost prohibitive. Consideration should be given to other possible alignment options or other design alternatives.

4.4.3 Phase IV Constructability Conditions and Constraints

Phase IV incudes an alignment that travels cross-country through heavily-forested ROW with steep cross slopes and one very steep downhill section to a connection at the Hare's Creek Crossing. The proposed alignment will again require extensive land clearing, timber harvest, access road grading and earthwork. As with the other phases, a minimum 25 to 40-feet wide temporary construction easement will likely be required for access road grading, pipe stringing, trench excavation, trench soil temporary storage, pipeline installation, trench backfill and compaction, and ROW restoration. SWPPP and erosion control will be a major consideration for this section to prevent sediment or other debris from entering the existing creeks and gulches. These measures will need to be installed and maintained during and after construction. Long term revegetation of the ROW, or permanent access road construction, will also be needed.

Existing Sunken Pipe Trench

Depending on environmental restrictions and allowed temporary workspace, the pipeline construction could allow for traditional open-cut direct buried pipeline installation. Some sections of the pipeline may require restrained joints for both pipe and fittings. Typical pipeline appurtenances such as blow-off valves and combination air release valves may be required at proposed high and low points. Mainline isolation valves may be required at a certain footage frequency to isolate sections of the pipeline. These valves will need to be protected and clearly marked with bollards or similar for future access.

As with the other phases, cathodic protection needs will be determined after the soils investigation is completed.

Based on the initial review from the site walk, HDD construction will probably not be a viable alternate for this segment because of the steep slopes and limited access. Given the environmentally-sensitive ROW, and many of the restrictive conditions listed above, any method of pipeline construction in this area will be very difficult and again possibly cost prohibitive. Consideration should be given to other possible alignment options.

4.4.4 Phase V Constructability Conditions and Constraints

Phase V will start at a connection to the existing pipeline from Waterfall Gulch near Forest Road 450 and travel cross country through heavily- forested ROW, with two steep downhill sections, to a connection at the Hare's Creek Crossing. The proposed alignment will require extensive land clearing, timber harvest, access road grading and earthwork. A minimum 25 to 40 feet wide temporary construction easement will likely be required for access road grading, pipe stringing, trench excavation, trench soils handling, installation of the pipeline, backfill and compaction, and restoration of the ROW.

This segment will also require the removal of an existing above-ground wooden trestle pipe bridge. The new pipeline would be open-cut direct buried in this section.

SWPPP and erosion control will again be a major consideration to prevent sediment or other debris from entering existing drainage channels. These measures will need to be installed and maintained during and after construction. Long term revegetation of ROW, or permanent access road construction, will also be needed.

Traditional open-cut direct-bury pipeline installation is likely across this section. Some sections of the pipeline may require restrained joints for both pipe and fittings. Typical pipeline appurtenances such as blow-off valves and combination air release valves may be required at proposed high and low points. As with other phases, mainline isolation valves may be required at a certain footage frequency to isolate sections of the pipeline. These valves will need to be protected and clearly marked with bollards or similar for future access. Cathodic protection needs will be determined after the ground investigation is completed.

Clamp Repair of Exposed Pipe

Based on the initial review from the site walk, HDD construction will probably not be a viable alternate for Phase V again because of the steep slopes and limited access. Given the environmentally-sensitive ROW, and many of the restrictive conditions listed above, any method of pipeline construction in the area of the existing pipeline will be very difficult and again possibly cost prohibitive. Consideration should be given to other possible alignment options.

4.5 Site Reconnaissance Walk Conclusions and Impacts for Alignment Evaluation and Design

Key conclusions from the site walk that will have impacts on the selection and evaluation of alignment alternatives to be presented in the Project Practicality Report, and then in the design of the selected pipeline, are as follows:

4.5.1 Phase II

- The Phase II replacement pipeline will probably follow the route of the existing water main from the Noyo River Crossing to the WTP, including use of the narrow access road on the benched slope.
- Control of storm water run-off down the narrow access road is needed to prevent slope and access road erosion.
- Installation of the pipeline in the bench needs ongoing slope creep first to be halted and further slope movement prevented for the long-term. Slope stabilization will probably require slope drains to reduce hydrostatic pressures that drive slope movement, and structures to prevent toe erosion and undercutting by the local stream.
- While the Noyo River Crossing isn't due for replacement, the pipelines that connect to it will cross the Noyo River floodplain. This crossing of the floodplain triggers environmental permitting under the Clean Water Act Section 404 and the CDFW Fish and Game Code Section 1600. If permitting is found to be onerous, the option of not replacing the pipe across the floodplain, or sliplining this pipe section and the crossing, will be discussed with the City.
- Coastal Zone permitting is required for part of the Phase II alignment.
- Open-cut trenching will be applicable for the Phase II route. Significant SWPPP and erosion control measures will be needed to prevent sediment discharge into local watercourses.
- There will be temporary construction impacts, including noise and dust, for residents in the sub-division south of Sherwood Road.
- A THP or a THP Exemption is unlikely to be needed for Phase II.

4.5.2 Phase III

- For all potential pipeline alignments in the vicinity of the existing water main at the top of the eastern slopes of Newman Gulch, construction activities that include removal of vegetation and / or trees risk worsening slope stability. If one of these alignments is selected, then sufficient setback from the top of the steep slopes will be needed.

- Construction at the top of the steep slopes also needs to consider those areas of steep slope that are vulnerable to debris slides. These are caused by the creek at the base of Newman Gulch undercutting the slope at its base.
- Extensive land clearing, timber harvest, access road grading and earthwork will probably be needed for most alignment alternatives in Phase III. While open-cut trenching will be feasible in most areas, construction costs will still be prohibitive in the heavily-vegetated / forested and steeply- sloped areas. HDD may be feasible in some areas, but access and staging restrictions will be considerable. The pipeline alignment alternative with the least amount of construction in this terrain will probably be the most practical and have significant cost and schedule advantages as a result.
- Significant SWPPP and erosion control measures will be needed to prevent sediment discharge into local watercourses.
- As with Phase II, the Noyo River Crossing isn't due for replacement. However, the pipelines that connect to it have to cross the Noyo River floodplain. This still triggers environmental permitting under the Clean Water Act Section 404 and the CDFW Fish and Game Code Section 1600. If permitting is found to be onerous, the option of not replacing the pipe across the floodplain, or sliplining this pipe section and the crossing, will be discussed with the City.
- Coastal Zone permitting is required for almost all of the Phase III alignment.
- Environmental impacts on sensitive flora and fauna habitat in Phase III are likely to be lessened the more easterly the alternative.
- A THP or a THP Exemption is very likely for Phase III.
- Historical and cultural recording of water control structures and old redwood pipelines may be needed as some facilities are more than 50 years old.

4.5.3 Phase IV

- For all potential pipeline alignments in the vicinity of the top of the steep slopes of Covington Gulch and the Hare Creek Crossing, construction activities that include removal of vegetation and / or trees risk worsening slope stability. If one of these alignments is selected, then sufficient setback from the top of the steep slopes will be needed.
- Construction at the top of the steep slopes also needs to consider those areas of steep slope that are vulnerable to debris slides. These are caused by the creeks at the bottom of these gorges undercutting the slopes at their bases.
- Extensive land clearing, timber harvest, access road grading and earthwork will probably be needed for most alignment alternatives in Phase IV. While

open-cut trenching will be feasible in most areas, construction costs will still be prohibitive in the heavily-vegetated / forested and steeply- sloped areas. HDD is unlikely to be feasible. The pipeline alignment alternative with the least amount of construction in this terrain will probably be the most practical and have significant cost and schedule advantages as a result.

- Significant SWPPP and erosion control measures will be needed to prevent sediment discharge into local watercourses.
- The Hare Creek Crossing isn't due for replacement. However, the pipelines that connect to it have to cross the creek's floodplain. This still triggers environmental permitting under the Clean Water Act Section 404 and the CDFW Fish and Game Code Section 1600. Options that do not require pipe replacement in the floodplain, or sliplining may be considered.
- There will be temporary construction impacts, including noise and dust, for residents in the residential areas south of Highway 20. This impacts about half of the Phase IV alignment.
- A THP or a THP Exemption is very likely for Phase IV.
- Historical and cultural recording of water control structures and old redwood pipelines may be needed as some facilities are more than 50 years old.

4.5.4 Phase V

- As with Phase IV, for all potential pipeline alignments in the vicinity of the top of the steep slopes of the Hare Creek Crossing, construction activities that include removal of vegetation and / or trees risk worsening slope stability. If one of these alignments is selected, then sufficient setback from the top of the steep slopes will be needed.
- Construction at the top of the steep slopes also needs to consider those areas of steep slope that are vulnerable to debris slides. These are caused by the creeks at the bottom of these gorges undercutting the slopes at their bases.
- Extensive land clearing, timber harvest, access road grading and earthwork will probably be needed for most alignment alternatives in Phase V. While open-cut trenching will be feasible in most areas, construction costs will still be prohibitive in the heavily-vegetated / forested and steeply- sloped areas. HDD is still unlikely to be feasible. The pipeline alignment alternative with the least amount of construction in this terrain will probably be the most practical and have significant cost and schedule advantages as a result.
- Significant SWPPP and erosion control measures will be needed to prevent sediment discharge into local watercourses.

- The Hare Creek Crossing isn't due for replacement. However, the pipelines that connect to it have to cross the creek's floodplain. This still triggers environmental permitting under the Clean Water Act Section 404 and the CDFW Fish and Game Code Section 1600. Options that do not require pipe replacement in the floodplain, or sliplining may be considered.
- A THP or a THP Exemption is very likely for Phase V.
- Historical and cultural recording of water control structures and old redwood pipelines may be needed as some facilities may be more than 50 years old.

5 ALTERNATIVE ALIGNMENTS FOR EVALUATION BY PHASE

5.1 General

In this section, we describe a series of alternative alignments and sub-alignments for each phase. These alignments include, for each phase, an alignment in close proximity to the existing water main. Alternative routes were developed from original studies performed by the Coleman Engineering team at the pre-proposal stage, from the results of the site reconnaissance walk, from subsequent work using the results of the LiDAR topographical mapping, and from City input.

Since the water main system operates under gravity surcharge throughout, this allows for more flexibility in selecting route alternatives. Each alignment and sub-alignment for each phase presented in the following sections has been checked initially to confirm that it will be able to convey the design flow of 300 gpm under continuous gravity surcharge from the Waterfall Gulch Intake to the WTP with just the existing hydraulic break at the Summers Lane Reservoir. A more detailed hydraulic check of each alignment and sub-alignment will be made during the 'fatal flaw' detailed evaluations.

5.2 Phase II

The potential Phase II alignment is shown on Figures 4 and 5.

We don't anticipate any significant deviation from the existing alignment from the Noyo River Crossing and along the narrow access road on the benched slope. Once the pipeline reaches the residential area at Sherwood Road there may be slight adjustments to suit easements and ROW. Within the WTP, the alignment will be to the west of the existing raw water storage ponds – the potential to feed both ponds and facilitate direct discharge into the influent wet well will be considered during the design phase.

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FIGURE 4: PHASE II – NORTH

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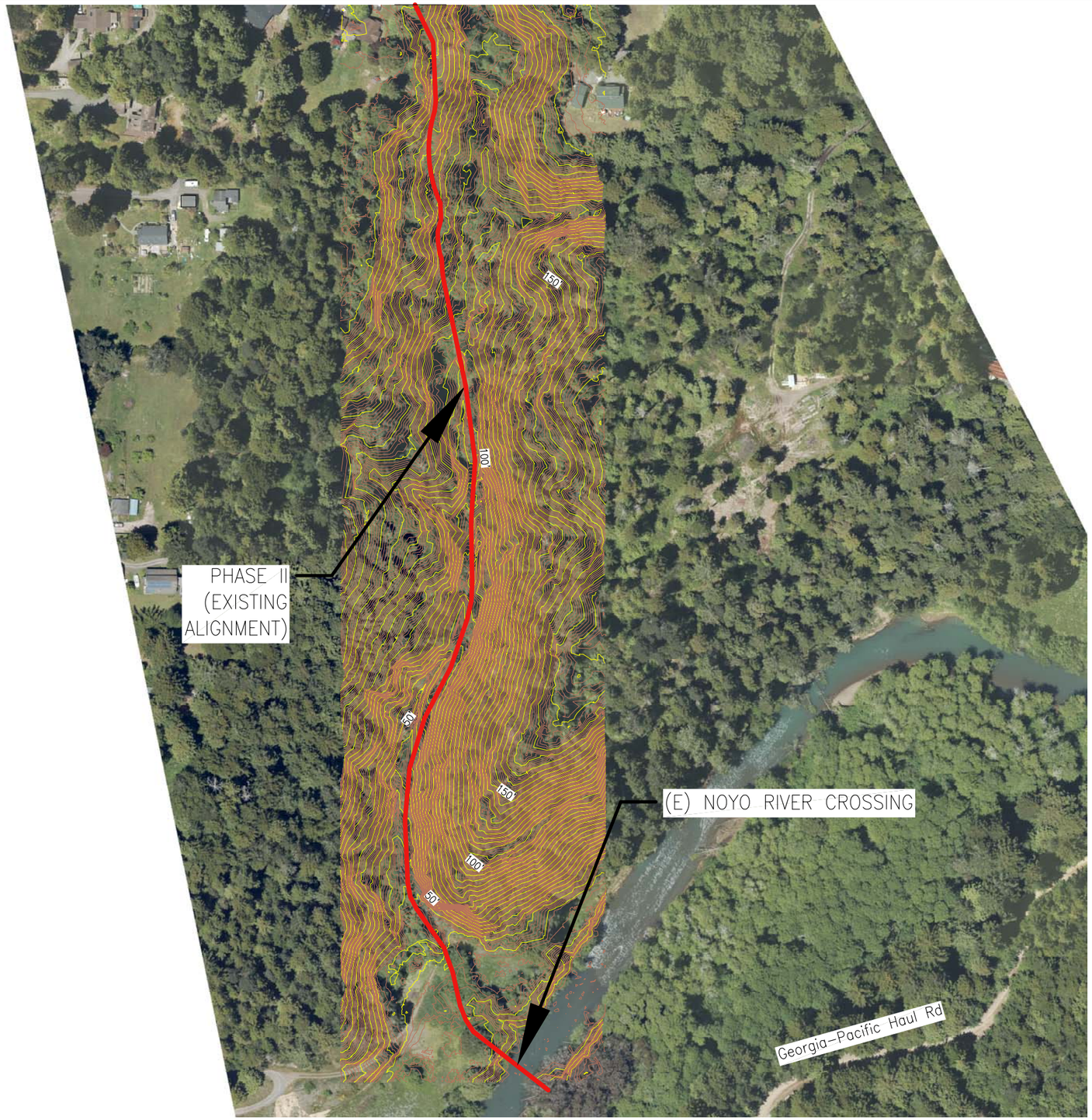

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FIGURE 5: PHASE II – SOUTH

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5.3 Phase III

Figures 6 and 7 show the potential alignment alternatives for Phase III. The section of pipeline from the southern end of the Noyo River Crossing to the Georgia Pacific Haul Road is common to all alignments.

Phase III.1 follows the existing water main alignment from the Georgia Pacific Haul Road along the eastern side of the pond to its south, and then up onto the top of the Newman Gulch eastern slopes to the Newman Gulch Intake.

Phase III.2 initially follows the Georgia Pacific Haul Road to the west before climbing up a relatively short length of steep slope onto relatively flatter terrain to the west of Newman Gulch but east of Hanson Road. The alignment continues to the Newman Gulch Intake on the west side of Newman Gulch.

Phase III.3 is a variant on Phase III.1. It takes a more easterly path after diverging from III.1 about halfway between the Newman Gulch Intake and the Georgia Pacific Haul Road. It potentially has easier construction along the haul road to the east, and initial environmental studies have shown that it has potentially less impact on sensitive flora and fauna habitat. There are three sub-alignment alternatives for Phase III.3:

A. A longer, more easterly track that maximizes use of the Georgia Pacific Haul Road.
B. A shorter route that stays at the top of the Newman Gulch eastern slopes as long as possible. This alternative may be impacted by sensitive flora and fauna habitat.
C. The shortest Phase III.3 route that does include some installation on the steep eastern slopes, but may also be impacted by sensitive flora and fauna habitat.

Table 3 below shows the approximate length of pipeline for each alternative.

Table 3: Approximate Pipeline Lengths for Phase III Alternatives

Alternative	Total Length, LF	Description
Phase III.1	3,800	Noyo River Crossing to Newman Gulch Intake via top of eastern slope of Newman Gulch (existing water main route)
Phase III.2	3,550	Noyo River Crossing to Newman Gulch Intake via Georgia Pacific Haul Road (W), and top of western slopes of Newman Gulch.
Phase III.3A	5,300	Noyo River Crossing to Newman Gulch Intake via Georgia Pacific Haul Road (E), east of Newman Gulch, using part of Phase III.1.

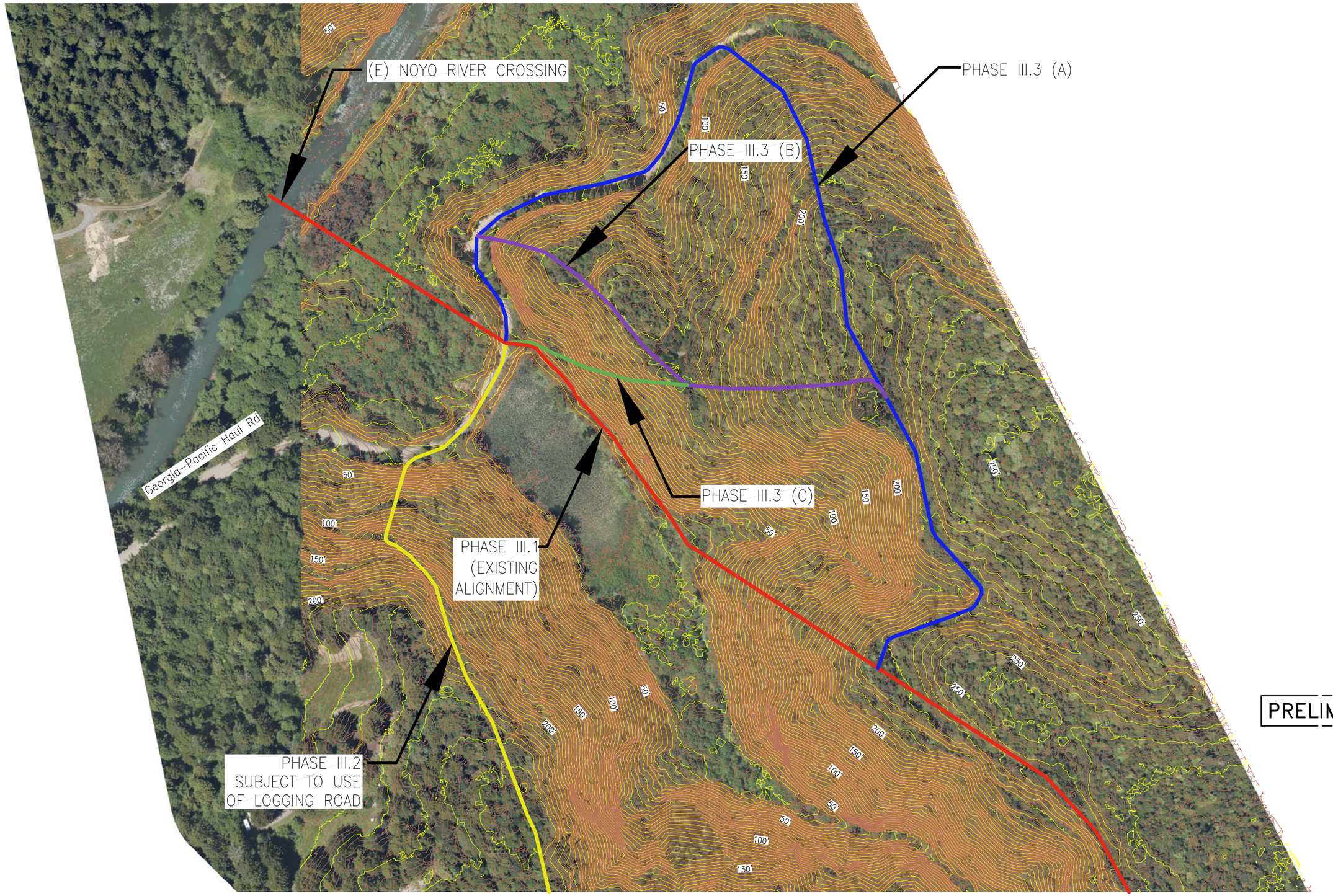

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FIGURE 6: PHASE III – NORTH

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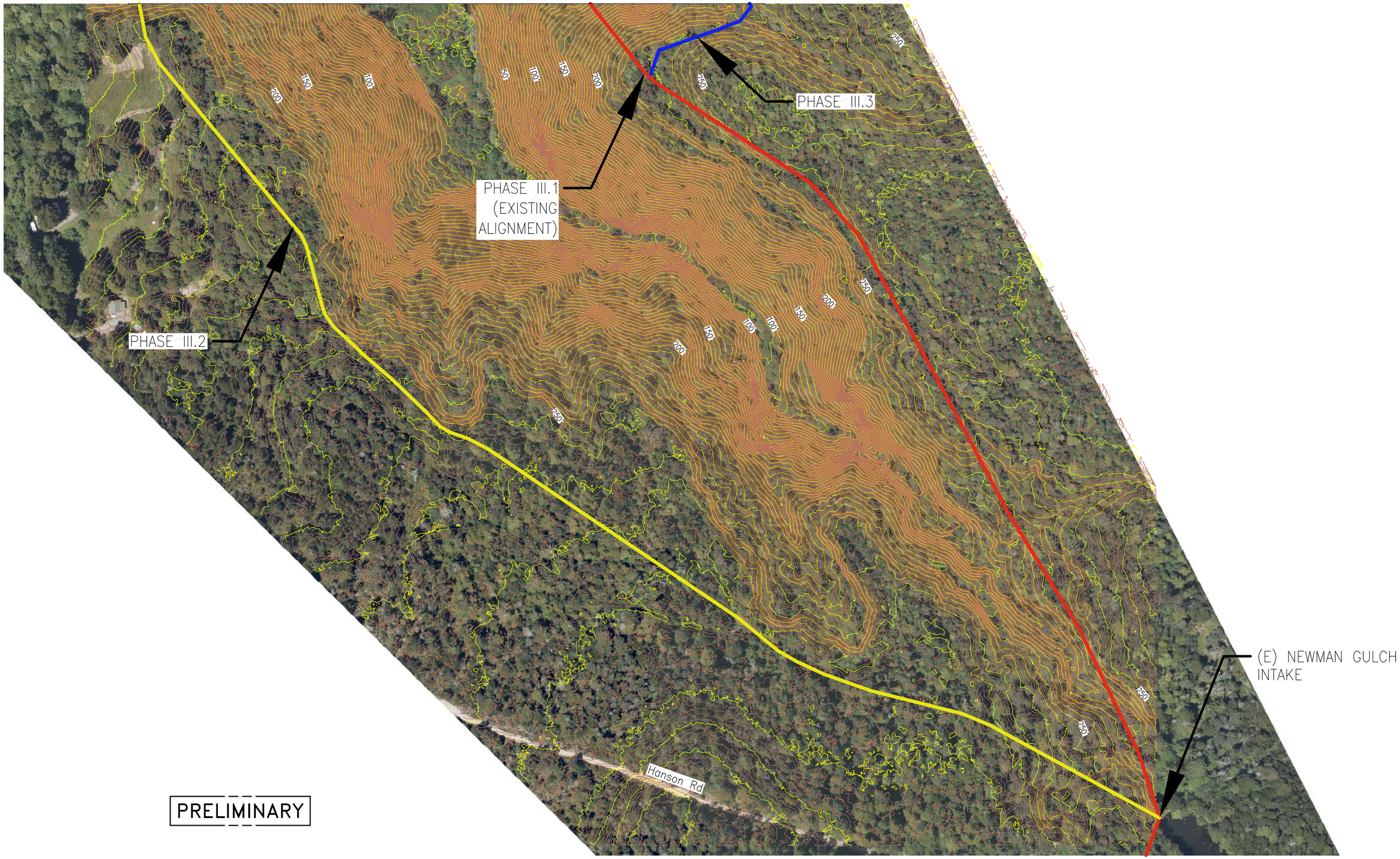

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FIGURE 7: PHASE III – SOUTH

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Alternative	Total Length, LF	Description
Phase III.3B	4,750	Noyo River Crossing to Newman Gulch Intake via part of Georgia Pacific Haul Road (E), east of Newman Gulch, using part of Phase III.1.
Phase III.3C	4,300	Noyo River Crossing to Newman Gulch Intake, east of Newman Gulch, using part of Phase III.1.

5.4 Phase IV

Phase IV is shown on Figures 8 and 9. There are a number of potential alternatives that make use of alternative routes through the residential areas south of Highway 20, and existing forest and logging roads and trails in the southern, heavily forested sections of this phase.

Phase IV.1 shows the approximate alignment of the existing water main through the residential area and down the steep slopes to the Hare Creek / Covington Gulch crossings.

Phase IV.2 initially runs to the east along the southern boundary of Highway 20 before turning south along Porterfield Lane. After travelling across relatively open ground it reaches a forest road and heads east to connect to Gravel Pit Road. The route then reverts to a westerly path along Gravel Pit Road (an alignment it shares with Phase IV.4 as detailed below) before connecting to the northern end of the Hare Creek Crossing.

Phase IV.3 improves on the route through the residential areas from Highway 20 by following Dwyer and Dryer Lanes before rejoining the Phase IV.1 alignment. It makes use of an easterly track along a forest road before heading south to connect again with the Phase IV.1 alignment just north of the Covington Gulch crossing.

Phase IV.4 is the most easterly route that makes extensive use of Gravel Pit Road. It travels east from the existing main crossing of Highway 20 along the southern boundary of the state highway to Gravel Pit Road. The pipeline then leaves the road to connect just north of the Hare Creek Crossing. It also avoids the Covington Gulch Crossing.

For Phases IV.1 and IV.3, the existing pipe segment immediately north of Covington Gulch that runs directly up the steep slope is above ground ductile-iron pipe, and may not need replacement.

Table 4 below shows the approximate length of pipeline for each alternative.

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FIGURE 8: PHASE IV – NORTH

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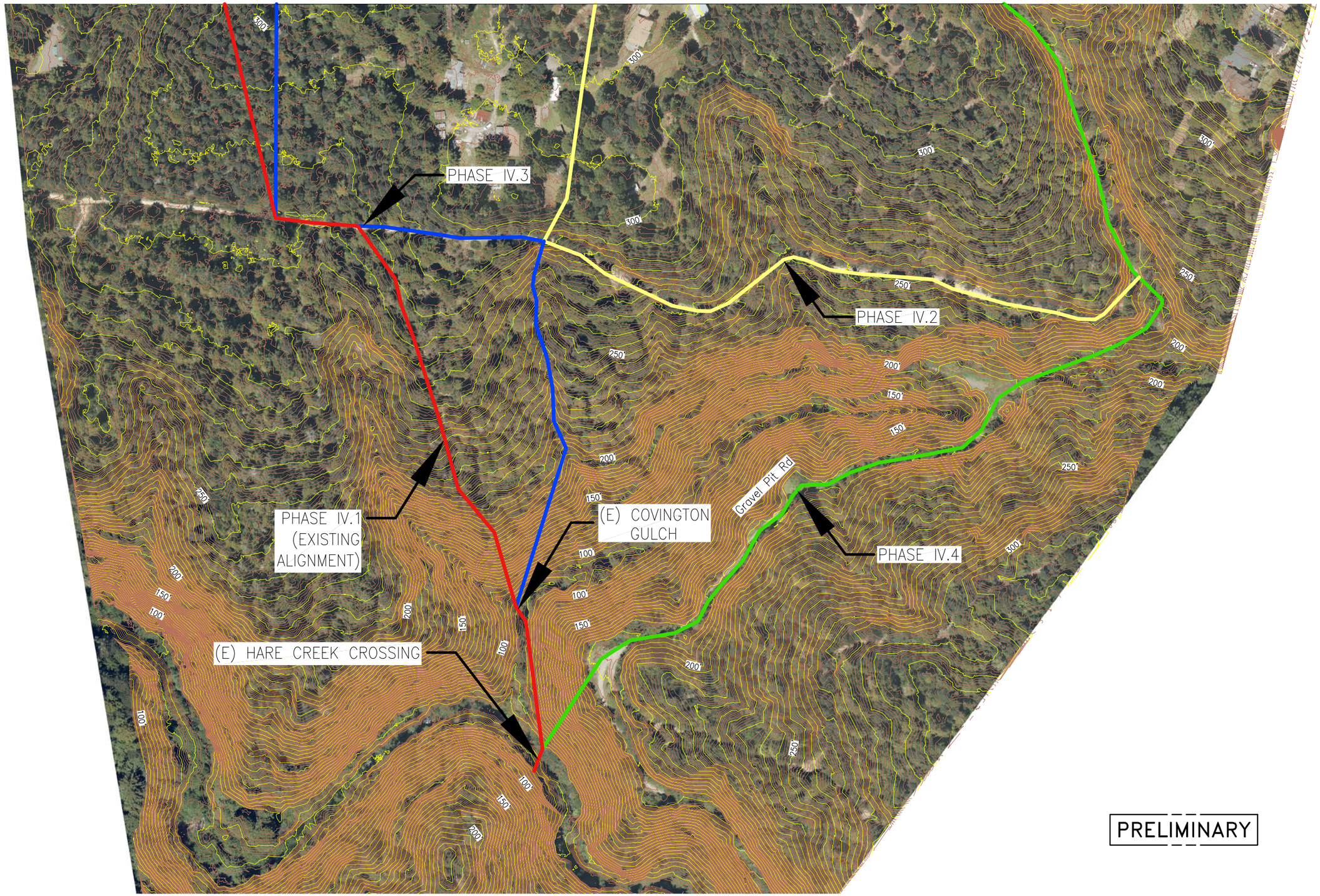

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9/26/16 S:_PROJECTS\TB018-001 - RAW WATER PIPELINE REPLACEMENT DESIGN\CADD\EXHIBITS\PHASE 4.2.DWG

COLEMAN ENGINEERING
COLEMAN ENGINEERING
1358 BLUE OAKS BOULEVARD
SUITE 200
ROSEVILLE, CA 95678
(916) 791-1188

BAR IS ONE INCH AT FULL SCALE
0 1"
IF NOT ONE INCH ON THIS SHEET SCALE ACCORDINGLY

NO.	REVISIONS	BY	APP	DATE
6				
5				
4				
3				
2				
1				

FORT BRAGG — **RAW WATER PIPELINE REPLACEMENT DESIGN**

FIGURE 9: PHASE IV – SOUTH

CITY OF FORT BRAGG — **CALIFORNIA**

DESIGNED UNDER THE DIRECTION OF:

SIMON N GRAY — DATE
R.C.E. No. 60311 - REGISTRATION EXPIRES 06-30-20

DESIGN: MS	DATE: 7/17/2019
DRAWN: WCJ	DATE: 7/17/2019
CHECKED: SNG	DATE: 7/17/2019

REGISTERED PROFESSIONAL ENGINEER — SIMON N. GRAY — No. C60311 Exp. 06-30-20 — CIVIL — STATE OF CALIFORNIA

SCALE 1"=100'
DRAWING NUMBER
SHEET NUMBER
OF SHEETS

Table 4: Approximate Pipeline Lengths for Phase IV Alternatives

Alternative	Total Length, LF	Description
Phase IV.1	3,100	Highway 20 crossing to Hare Creek Crossing (existing water main route).
Phase IV.2	5,850	Highway 20 crossing to Hare Creek Crossing via state highway, Porterfield Lane, Forest Road and Gravel Pit Road.
PhaseIV.3	3,700	Highway 20 crossing to Hare Creek Crossing via Dwyer and Dryer Lanes, and Forest Road.
Phase IV.4	6,000	Highway 20 crossing to Hare Creek Crossing via state highway and Gravel Pit Road.

5.5 Phase V

Figure 10 shows the two Phase V alignment alternatives. Phase V.1 shows the approximate alignment of the existing water main from the Hare Creek Crossing, up its steep western slopes and across heavily forested terrain to the existing above ground pipeline supported by a wooden trestle, and then to Forest Road 450. Phase V.2 is a less direct route to the west of Phase V.1 that aims to follow an existing logging road / trail and a shorter section of steep terrain up from the Hare's Creek Crossing and make use of flatter ground and a forest road to the west.

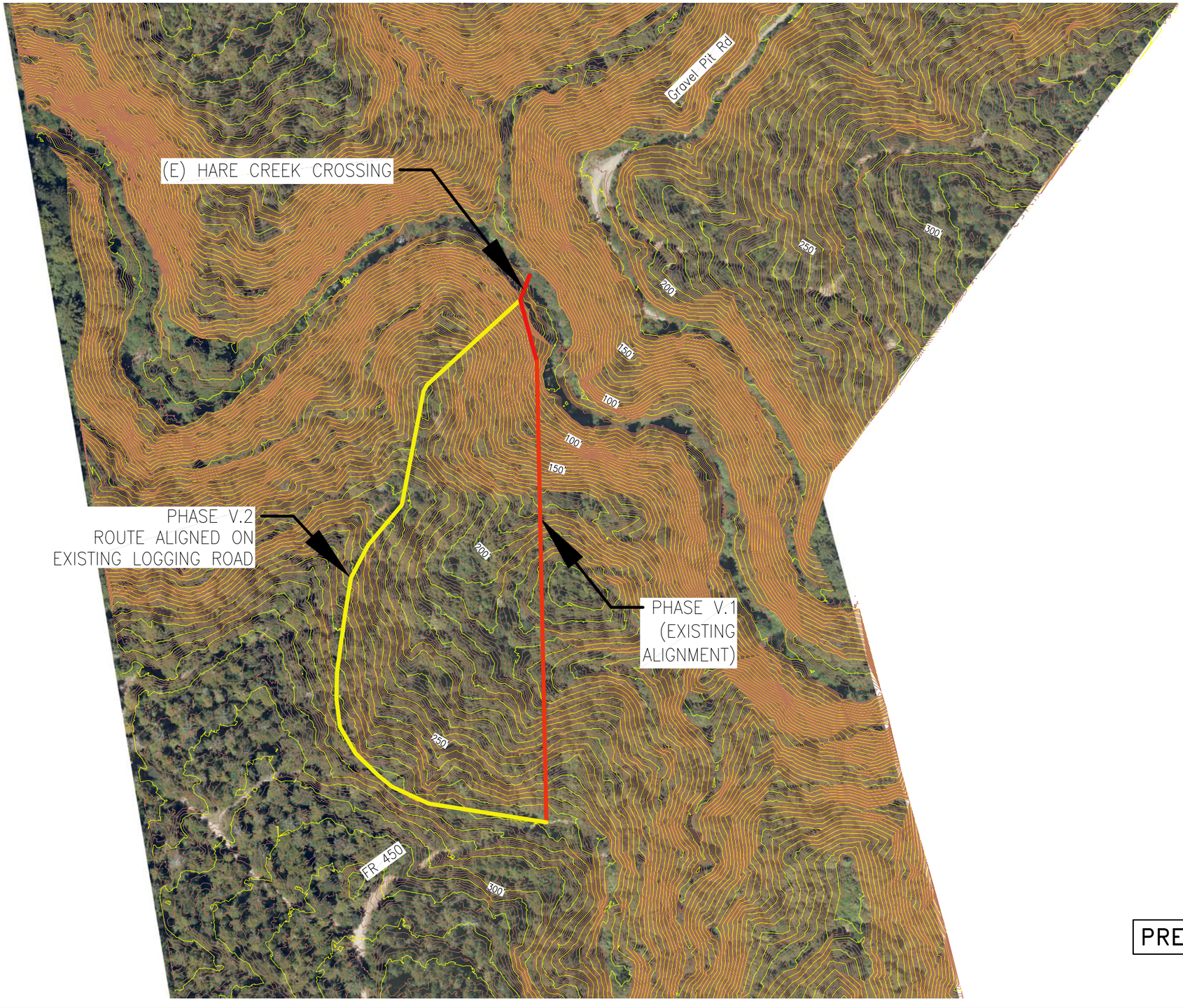
Table 5 below shows the approximate length of pipeline for each alternative.

Table 5: Approximate Pipeline Lengths for Phase V Alternatives

Alternative	Total Length, LF	Description
Phase V.1	1,050	Hare Creek Crossing to Forest Road 450 (existing water main route).
Phase V.2	1,400	Hare Creek Crossing to Forest Road 450. More westerly route using shorter steep slope section and forest roads.

6 NEXT STEPS

This TM has presented a review of available data and information related to the existing raw water pipe, and has described existing conditions and constraints for its replacement, based in part on a full-team site reconnaissance walk. The data and information review and site walk findings have been used to develop a series of pipeline alignment alternatives by phase that are described and presented in this document.



PRELIMINARY

COLEMAN ENGINEERING	COLEMAN ENGINEERING 1358 BLUE OAKS BOULEVARD SUITE 200 ROSEVILLE, CA 95678 (916) 791-1188	BAR IS ONE INCH AT FULL SCALE 0 — 1" IF NOT ONE INCH ON THIS SHEET SCALE ACCORDINGLY

NO.	REVISIONS	BY	APP	DATE
6				
5				
4				
3				
2				
1				

FORT BRAGG — **RAW WATER PIPELINE REPLACEMENT DESIGN**

FIGURE 10: PHASE V

CITY OF FORT BRAGG — **CALIFORNIA**

DESIGNED UNDER THE DIRECTION OF:

SIMON N GRAY — DATE
R.C.E. No. 60311 - REGISTRATION EXPIRES 06-30-20

DESIGN:	MS	DATE: 7/17/2019
DRAWN:	WCJ	DATE: 7/17/2019
CHECKED:	SNG	DATE: 7/17/2019

REGISTERED PROFESSIONAL ENGINEER — SIMON N. GRAY — No. C60311 Exp. 06-30-20 — CIVIL — STATE OF CALIFORNIA

SCALE 1"=100'

DRAWING NUMBER

SHEET NUMBER

OF SHEETS

9/26/16 S:_PROJECTS\TTBG18-001 - RAW WATER PIPELINE REPLACEMENT DESIGN\CADD\EXHIBITS\PHASE 5.DWG

The pipeline alignment alternatives for each phase will now be evaluated so that a recommended pipeline route for all phases can be identified and carried forward into design. The evaluation will be in two stages:

- An initial 'fatal-flaw' analysis to ensure that there are no challenges for each alternative that cannot be overcome (e.g. environmental / THP impacts that cannot be mitigated except by re-routing, an inability to obtain easements / right-of-way / permits, or hydraulic inadequacy), followed by:

- A detailed evaluation that includes capital costs and life cycle costs; ease of, and costs to, acquire easements / right-of-way; ease of operation and maintenance; constructability; geotechnical and geologic hazard assessment; pipe hydraulics and pipe sizing; environmental impacts and costs of mitigation; ease of permitting; extent of tree removal and the THP; and public impacts during and after construction.

The evaluations will be detailed in the next project deliverable: The Project Practicality Report. This Report will include content from this TM. Workshop No. 1 will be held after City review of the Project Practicality Report to confirm the proposed project to be carried forward to preliminary and final design.

APPENDICES

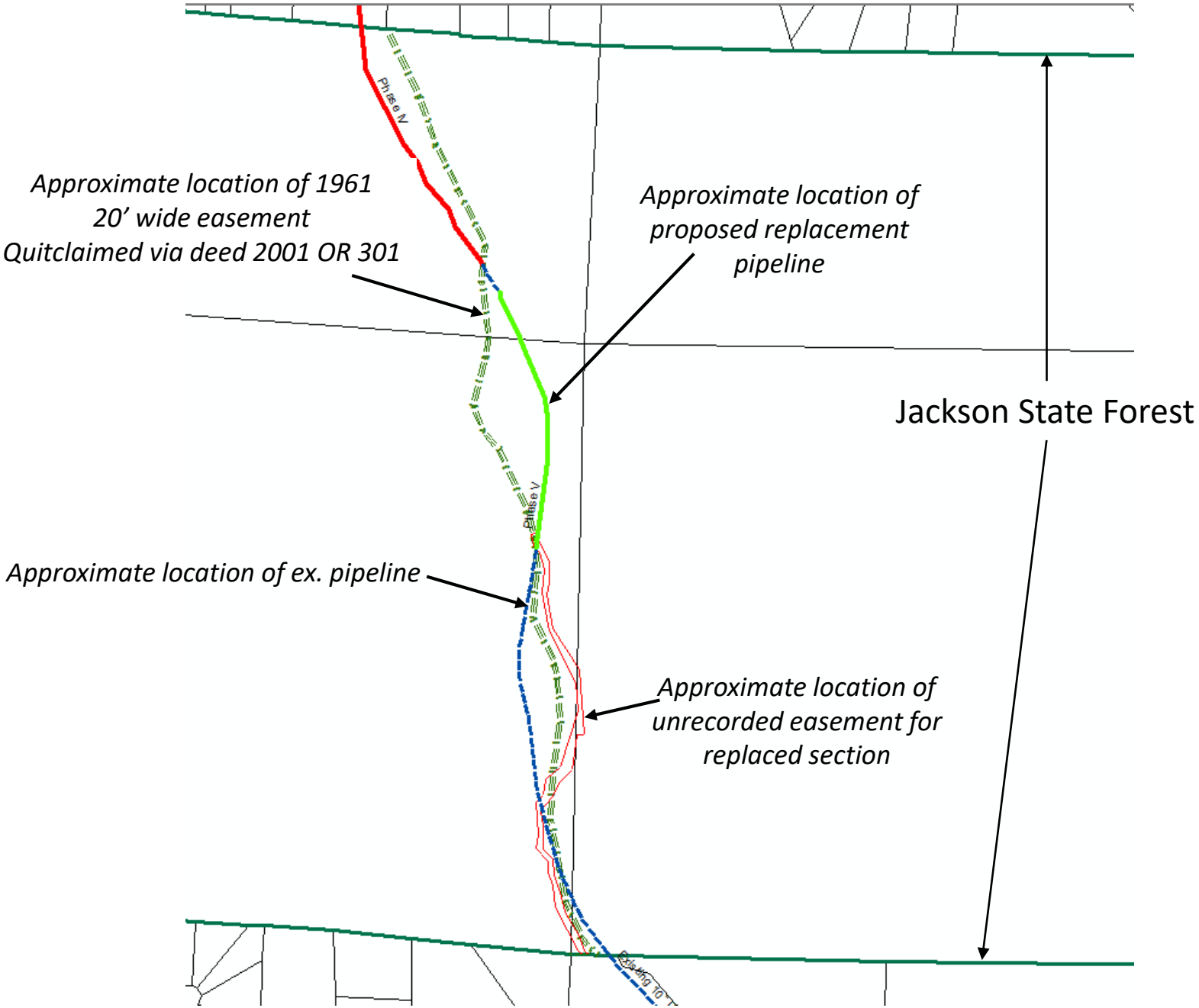
A. Summaries of Easements along the Pipeline Routes.

APPENDIX A: SUMMARIES OF EASEMENTS ALONG THE PIPELINE ROUTES

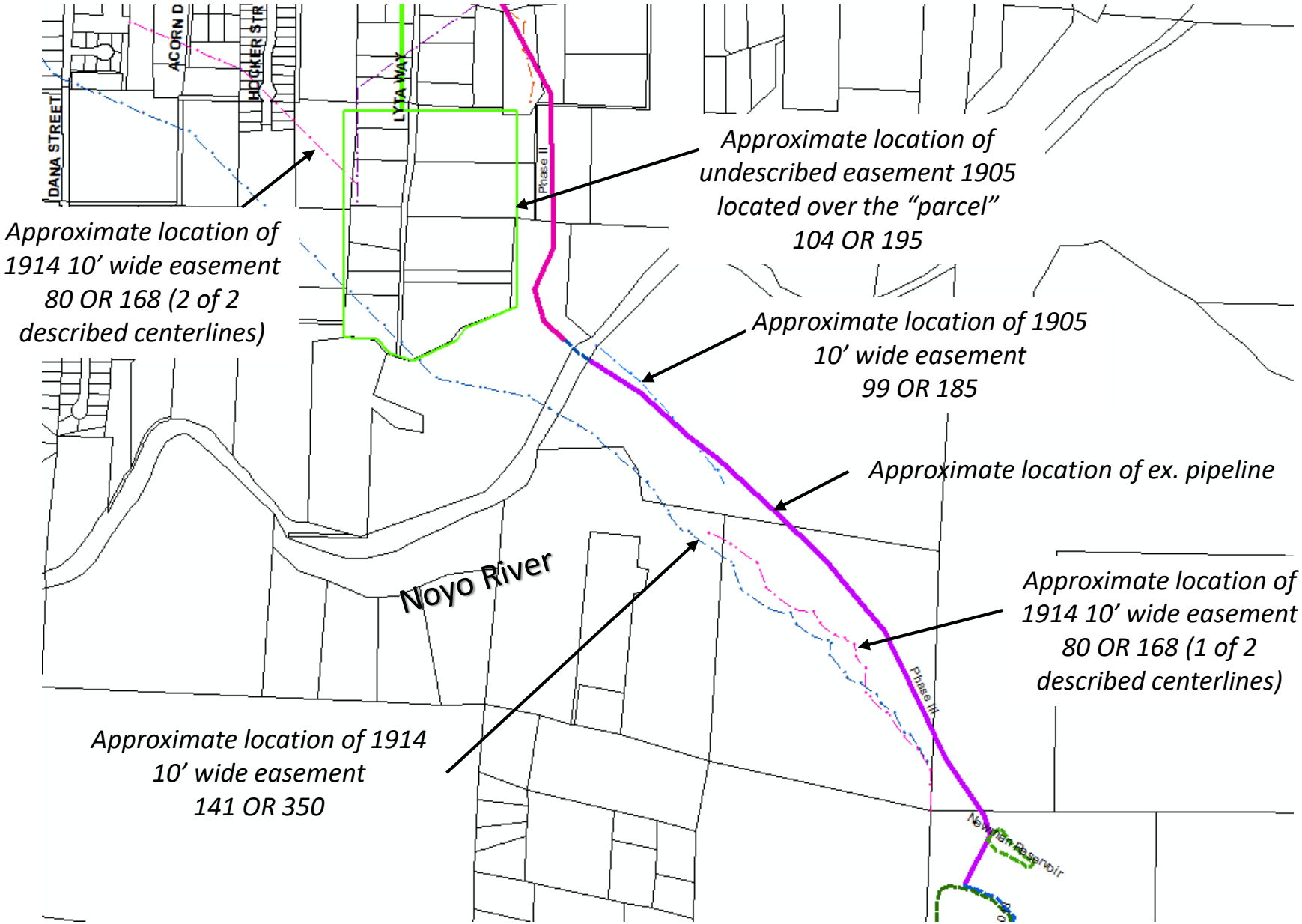
NOTE

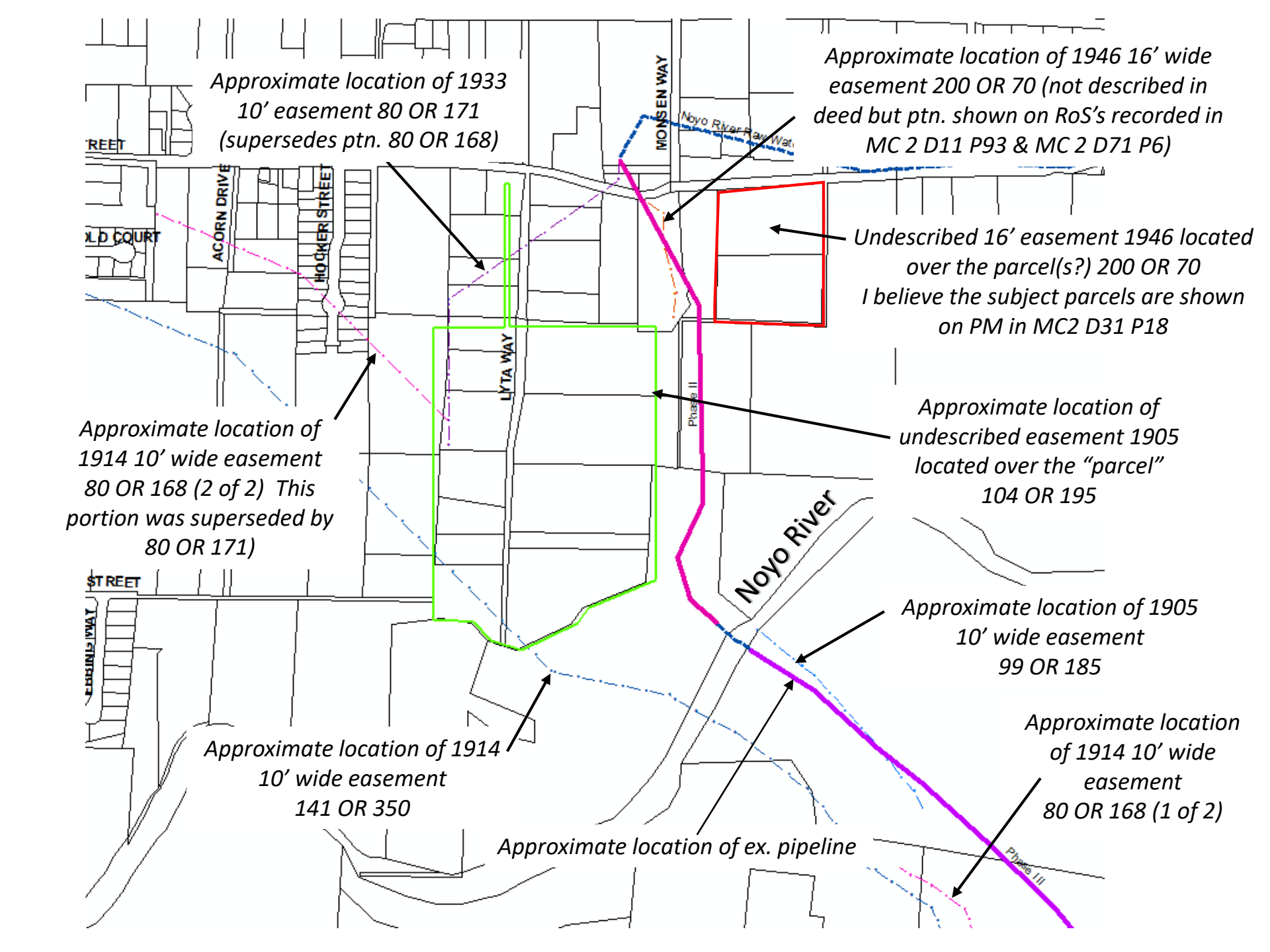
Easements were located using graphically determined section corners per USGS topo maps

Easement from 104 OR 195 was shifted to partially match existing parcel configurations.


Approximate location of 1961
20' wide easement
Quitclaimed via deed 2001 OR 301
Approximate location of
proposed replacement
pipeline
Jackson State Forest
Approximate location of ex. pipeline
Approximate location of
unrecorded easement for
replaced section


Approximate location of pipeline
Approximate location of 1934 10' wide easement 95 OR 330
Phase IV


DANA STREET
ACORN D
HOOKER STR
LYTA WAY
Phase II
Phase III
Noyo River
Approximate location of undescribed easement 1905 located over the "parcel" 104 OR 195
Approximate location of 1914 10' wide easement 80 OR 168 (2 of 2 described centerlines)
Approximate location of 1905 10' wide easement 99 OR 185
Approximate location of ex. pipeline
Approximate location of 1914 10' wide easement 80 OR 168 (1 of 2 described centerlines)
Approximate location of 1914 10' wide easement 141 OR 350


Approximate location of 1933 10' easement 80 OR 171 (supersedes ptn. 80 OR 168)
Approximate location of 1946 16' wide easement 200 OR 70 (not described in deed but ptn. shown on RoS's recorded in MC 2 D11 P93 & MC 2 D71 P6)
Undescribed 16' easement 1946 located over the parcel(s?) 200 OR 70
I believe the subject parcels are shown on PM in MC2 D31 P18
Approximate location of 1914 10' wide easement 80 OR 168 (2 of 2) This portion was superseded by 80 OR 171)
Approximate location of undescribed easement 1905 located over the "parcel" 104 OR 195
Approximate location of 1905 10' wide easement 99 OR 185
Approximate location of 1914 10' wide easement 141 OR 350
Approximate location of ex. pipeline
Approximate location of 1914 10' wide easement 80 OR 168 (1 of 2)
MONSEN WAY
ACORN DRIVE
HOOKER STREET
LYTA WAY
Phase II
Phase III
Noyo River
Noyo River Raw Wat
REET
LD COURT
ST REET