Fault S-2 is a 2.5-mile-long, northeast-trending tear fault. It is approximately 900 feet downstream of the left abutment of the proposed Sites Dam, 700 feet downstream of the axis, and approximately 100 feet downstream of the toe on the right abutment (Figures B.2-9 and B.2-10). The trend of Fault S-2 changes from approximately North 60 degrees East at the right abutment toe, to North 70 degrees East midway up the right abutment. In their fault trench studies, WLA determined that Fault S-2 is a narrow, sub-vertical bedrock shear zone that has a maximum right-lateral separation of approximately 550 feet.

Several landslides and slumps were identified in both the right and left abutments (Figures B.2-9 and B.2-10). Two landslides were mapped on the left abutment, in Boxer Formation mudstones, within the footprint of the dam, upstream of the axis. Both are considered small, do not exceed a depth of 30 feet, and would be removed during excavation of the abutment. A larger slide of just less than 6 acres was mapped on the right abutment, approximately 600 feet upstream of the axis, in the upstream portion of the dam footprint (Figures B.2-9 and B.2-10). A toe bulge of up to 3 feet was observed in the western edge of the slide, but no bulge was detected to the east (inside the footprint). The depth of this slide does not appear to exceed 35 feet. Two additional minor landslides were mapped at the downstream toe of the right abutment, in the Cortina Formation.

Water pressure testing in exploration drill holes at the Sites Dam generally indicated that the slightly weathered and fresh foundation bedrock is fairly impermeable, with some localized zones of potentially high hydraulic conductivity closer to the surface. High water takes (more permeable zones) generally occurred to depths of 40 to 60 feet below the proposed excavation surface, with the rock mostly tight below 60 feet.

Groundwater ranged from elevations of 343 feet in the left abutment, to approximately 260 feet in the channel (representative of surface water elevations in Stone Corral Creek), and to approximately 450 feet in the right abutment.

Sites Reservoir Saddle Dam Sites and Emergency Signal Spillway

The nine saddle dams and emergency spillway proposed for the 1.8 MAF Sites Reservoir are in the northern part of the reservoir, as shown on Figure B.2-13. The 1.3 MAF reservoir would have fewer saddle dams because the maximum WSE is 40 feet lower. Saddle dams would be constructed on interbedded mudstone, sandstone, and conglomerate sedimentary rocks of the Boxer Formation (Figure B.2-13). Overlying the bedrock is a lean to fat clay with a sand, colluvial cover (Qc), typically ranging from 5 to 25 feet in depth.

The geologic rock units strike roughly north-south, with a dip that ranges from west to east, depending on the location of the saddle dam with respect to the Fruto syncline, which trends just west of Saddle Dam 9. Bedding associated with the eastern limb of the syncline dips at approximately 20 degrees West at Saddle Dam 8, and flattens to 5 degrees West at Saddle Dam 9. Bedding dip direction gradually changes from west to east near the intersection of the Salt Lake fault, and possibly the northern extension of the Sites anticline in the vicinity of Saddle Dam 1 and Saddle Dam 2.

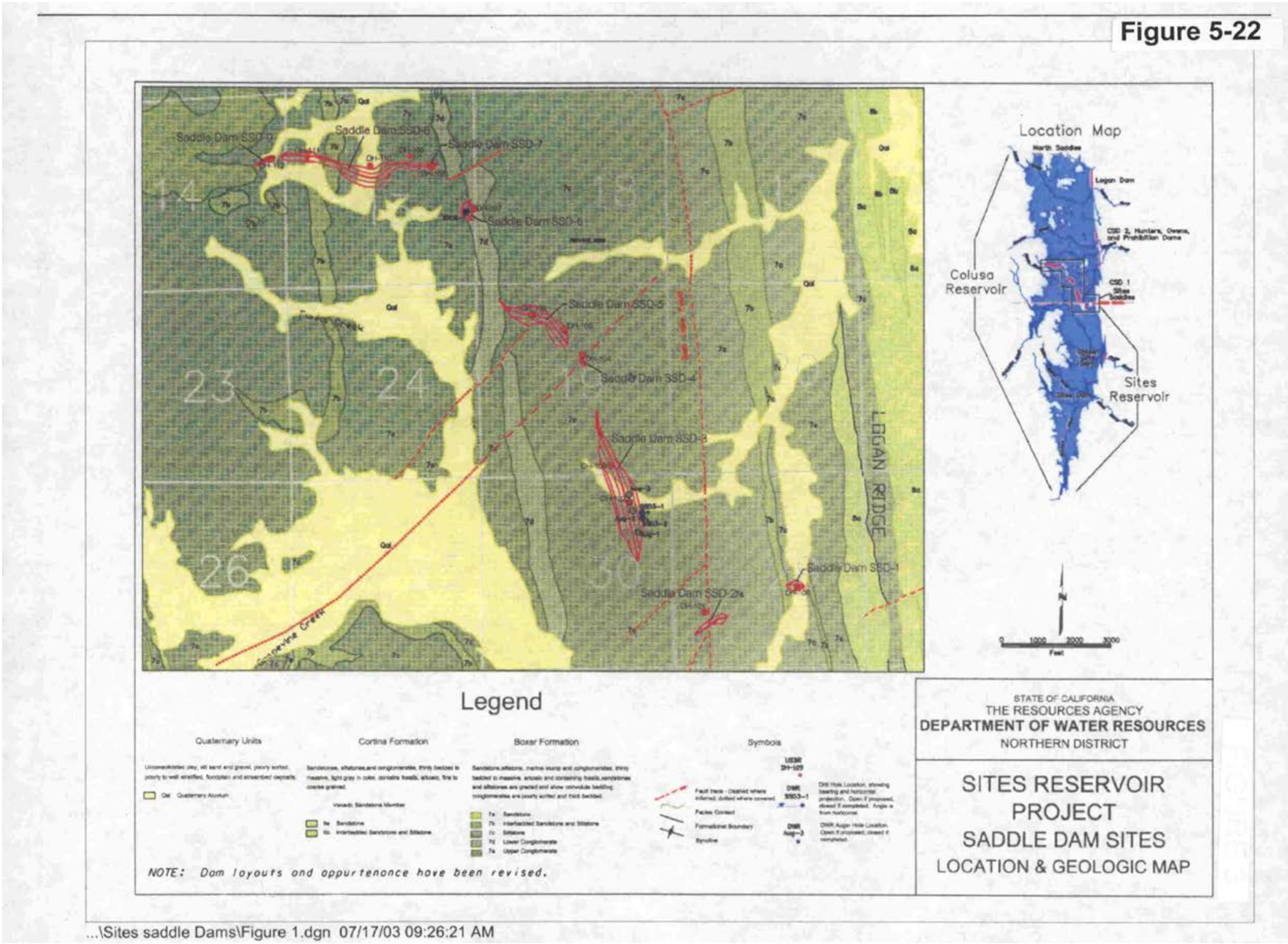

Figure B.2-13. NODOS/Sites Reservoir Project – Saddle Dam Sites – Location and Geologic Map

Bedrock at the saddle dam sites is generally approximately 70 percent mudstone (Kbm), 25 percent sandstone (Kbs), and 5 percent massive conglomerate (Kbcgl). The mudstone ranges from decomposed to fresh, intensely to slightly fractured, friable to moderately hard, weak to moderately strong, and laminar to thinly bedded. The sandstone is thinly to very thickly bedded, decomposed to fresh, intensely to moderately fractured, low hardness to hard, and weak to very strong. Bedding trends between North 30 degrees West and North 20 degrees East, dipping approximately 65 degrees to 70 degrees East, to 20 degrees to 40 degrees West.

The conglomerate exposed on the left abutment of Saddle Dam 5 is mostly low hardness to hard, weak to strong, intensely to closely fractured, very thick-bedded, and contains 45 percent sandstone and 5 percent mudstone interbeds.

The Salt Lake fault, judged capable of generating up to 16 inches of reverse displacement in a single event (WLA 2002), has been projected through the left abutment of Saddle Dam 2 (Figure B.2-13). A northeast-trending tear fault is projected through the center of Saddle Dam 4 (Figure B.2-13), but has not been verified. At least two northeast-trending shear zones, referred to as lineaments LSSD5-4 and LSSD5-3, are projected through Saddle Dam 5. Lineament LSSD5-4 is projected through the middle of the dam axis, and lineament LSSD5-3 trends through a proposed slurry wall (Figure B.2-13).

Minor surficial landslides and slumps were mapped on the right abutment and upstream of the left abutment of Saddle Dam 1, but are not considered to be a problem.

The section titled “Sites Reservoir Emergency Signal Spillway” in Section B.3, Design Considerations, provides siting information and proposed details for the emergency signal spillway for the 1.8 MAF and 1.3 MAF reservoirs.

Sites Reservoir Inlet/Outlet Works

Two alignments were considered for the inlet/outlet tunnel from the Sites Pumping/Generating Plant (SPGP) location. The two alignments are referred to as the Long Tunnel (approximately 4,000 feet) and the Short Tunnel (approximately 2,500 feet), both with a gate shaft option or multi-level outlet works option. Both the Long and Short Tunnels are designed to be 30 feet in diameter. Initially, the Long Tunnel alignment, along with the gate shaft option, was investigated because it avoided the intersection of Fault GG-2 in the tunnel, and only encountered the fault in the intake channel in the reservoir (Figures B.2-14 through B.2-21). The geologic profile along this alignment is illustrated on Figures Figure B.2-22 and Figure B.2-23. The Short Tunnel alignment alternative would encounter Fault GG-2 approximately 600 feet downstream of the proposed intake tower.

The proposed 30-foot-diameter concrete-lined tunnel for both the Long and Short Tunnel alignments would be through the Cortina and Boxer Formations, characterized by interbedded sandstones (Kcvsm) and mudstones (Kbm). Maximum cover for the Long and Short Tunnel alignments would be approximately 550 and 400 feet, respectively. Geologic mapping indicates that approximately 500 feet, or 20 percent, of the Short Tunnel alignment would be in the Boxer Formation, which consists of approximately 70 percent mudstone. The remaining 2,000 feet, or 80 percent, of the alignment would encounter the Cortina Formation, which is approximately 70 percent laminated to thinly bedded mudstone with very-thinly to thickly bedded sandstone interbeds. The Cortina Formation consists of very thinly- to very thickly bedded sandstone with laminated to thinly bedded mudstone.

Fresh sandstone is generally hard and strong, and fresh mudstone is moderately hard and moderately strong. Sandstone and mudstone core samples from exploration tunnel drill holes were submitted for testing. Table 8 of the Project Geology Report 94-30-02 lists the test results. Based on preliminary drill hole information, tunneling conditions through these sedimentary rocks would be good. Strike of the bedding is roughly north-south, nearly normal to the tunnel alignment, with an average dip of approximately 50 degrees East. Drill hole logs indicate that some steeply-dipping (70-degree) shears may be present at tunnel grade.

Some instability or minor overbreak may occur in the crown associated with laminated bedding of the mudstone. Moderate overbreak may occur along the tunnel walls where shears and associated fractured rock are present. Rock quality designation (RQD) values indicate that tunnel support requirements would use light- to moderate-weight steel sets on approximately 4-foot centers. Local areas of fractured rock associated with shearing may require heavier steel sets and/or closer spacing.

All five of the tunnel exploration drill holes showed groundwater levels well above tunnel grade, indicating that groundwater would be encountered during tunnel excavation. Figures Figure B.2-22 and Figure B.2-23 illustrate drill hole groundwater levels. One drill hole encountered artesian flows estimated to be approximately 10 gallons per minute, indicating that some isolated, confined, high groundwater flows would be encountered during the tunnel excavation. In addition, water pressure testing was performed in the tunnel drill holes to estimate permeabilities for the tilted strata, especially where they intersect the tunnel alignment. Water pressure tests at tunnel grade in the five exploration holes showed no water losses, indicating that the rock in the tunnel at these locations is fairly impermeable. Subsequent references to Funks Reservoir indicate the existing reservoir.

SPGP, Approach Channel, and Funks Reservoir

The evaluation described below was prepared at a time when the existing Funks Reservoir was to be incorporated into the NODOS/Sites Reservoir Project within its existing limits. However, to enhance power generation opportunities, the Holthouse Reservoir facility (an expansion of the existing Funks Reservoir) has since been developed. Holthouse Reservoir would involve constructing a new dam east of the existing Funks Dam, and breaching the existing dam to form a larger reservoir with an active storage of approximately 6,500 AF. The SPGP channel would be deepened and extended eastward beyond the limits shown on the figures referenced below to connect into the expanded reservoir. Additional geotechnical investigation would be required as part of future development work for the new dam, and along the extended channel alignment.

The proposed SPGP, the associated approach channel from Funks Reservoir, and Funks Reservoir itself, are on the eastern side of the primary ridge at the right abutment of Golden Gate Dam. The curved approach channel would extend approximately 5,000 feet from Funks Reservoir (Figures B.2-18 through B.2-21).

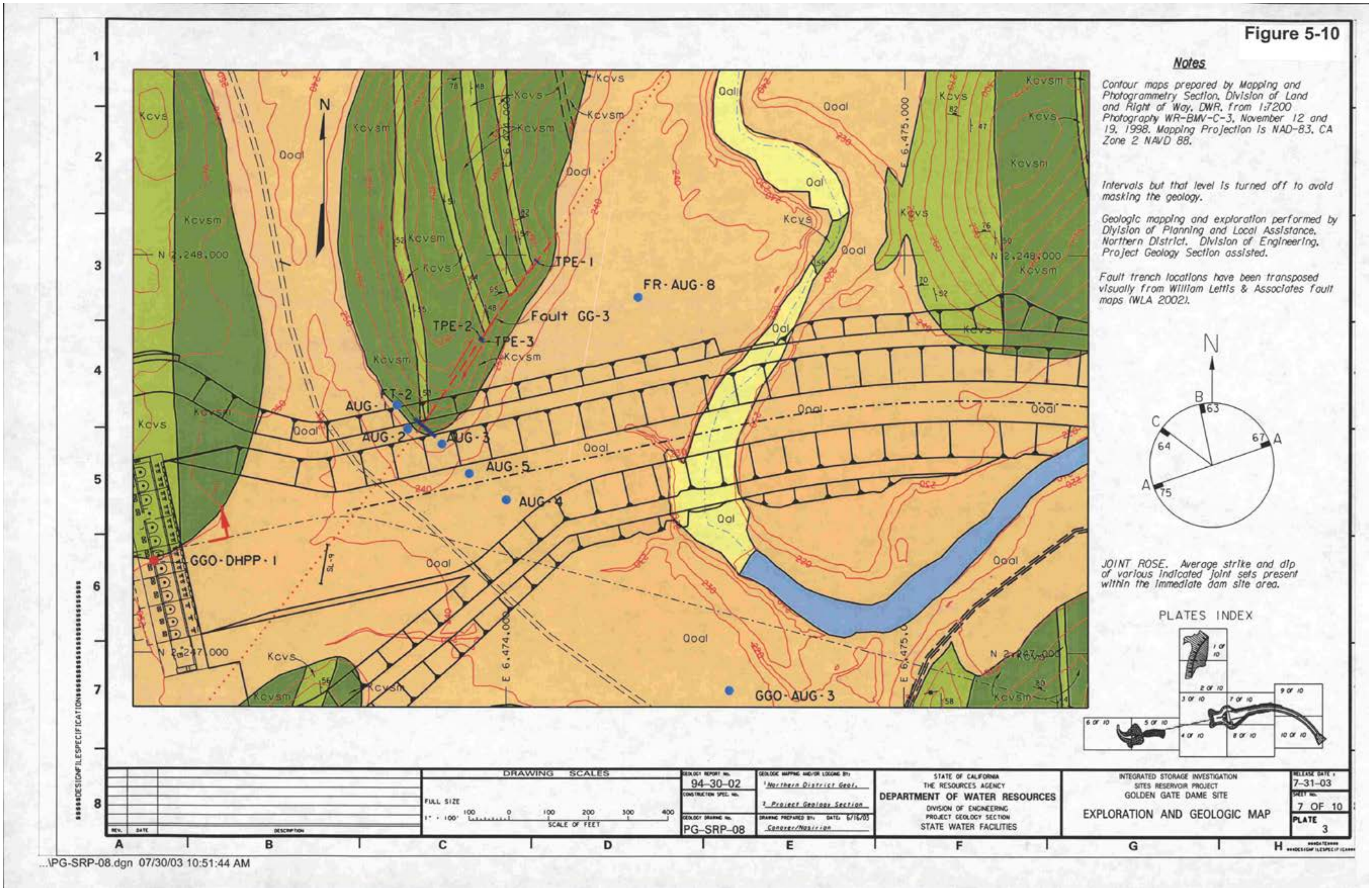

Figure B.2-14. Golden Gate Dam Site – Exploration and Geologic Map (Sheet 1)

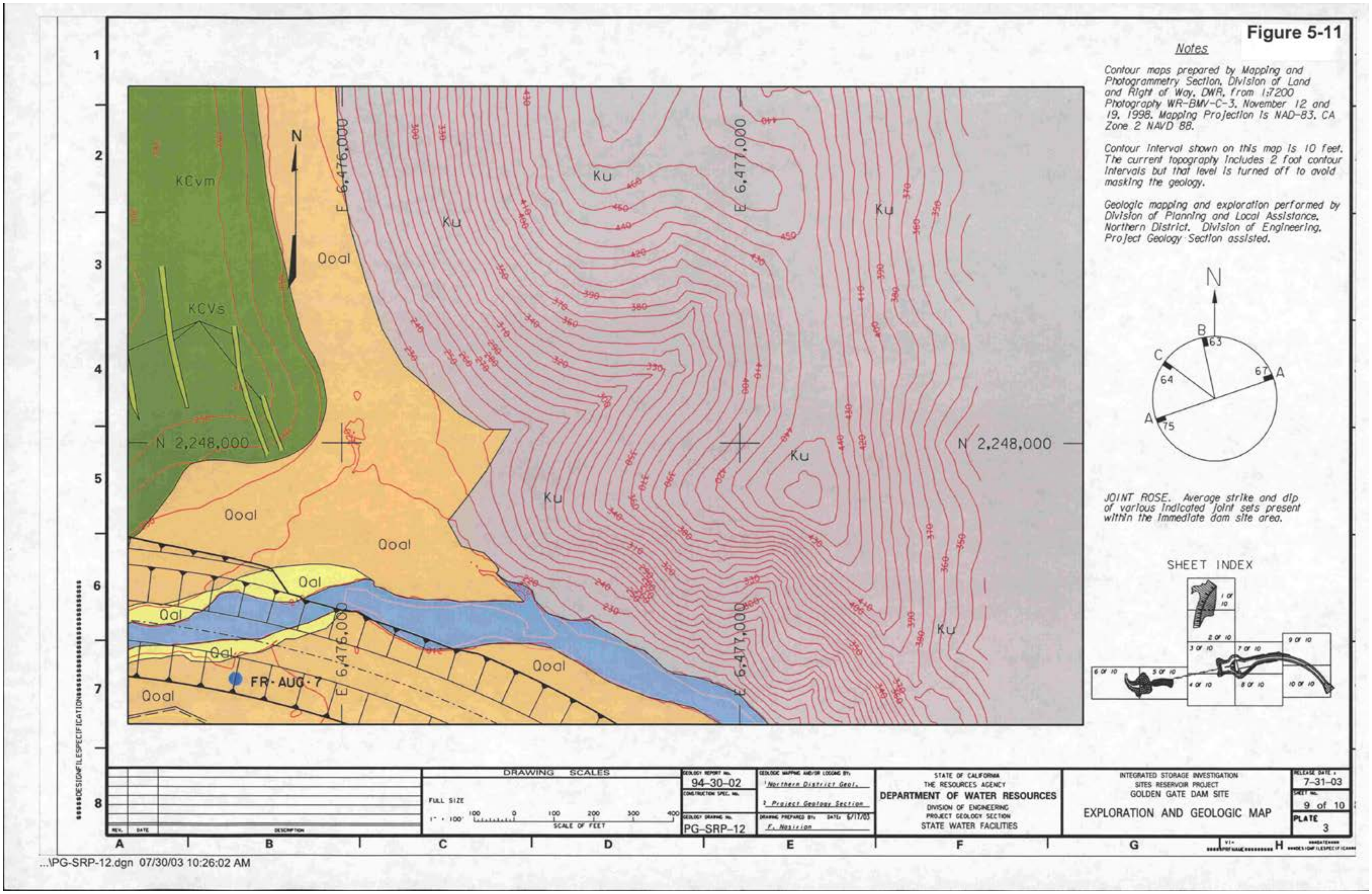

Figure B.2-15. Golden Gate Dam Site – Exploration and Geologic Map (Sheet 2)

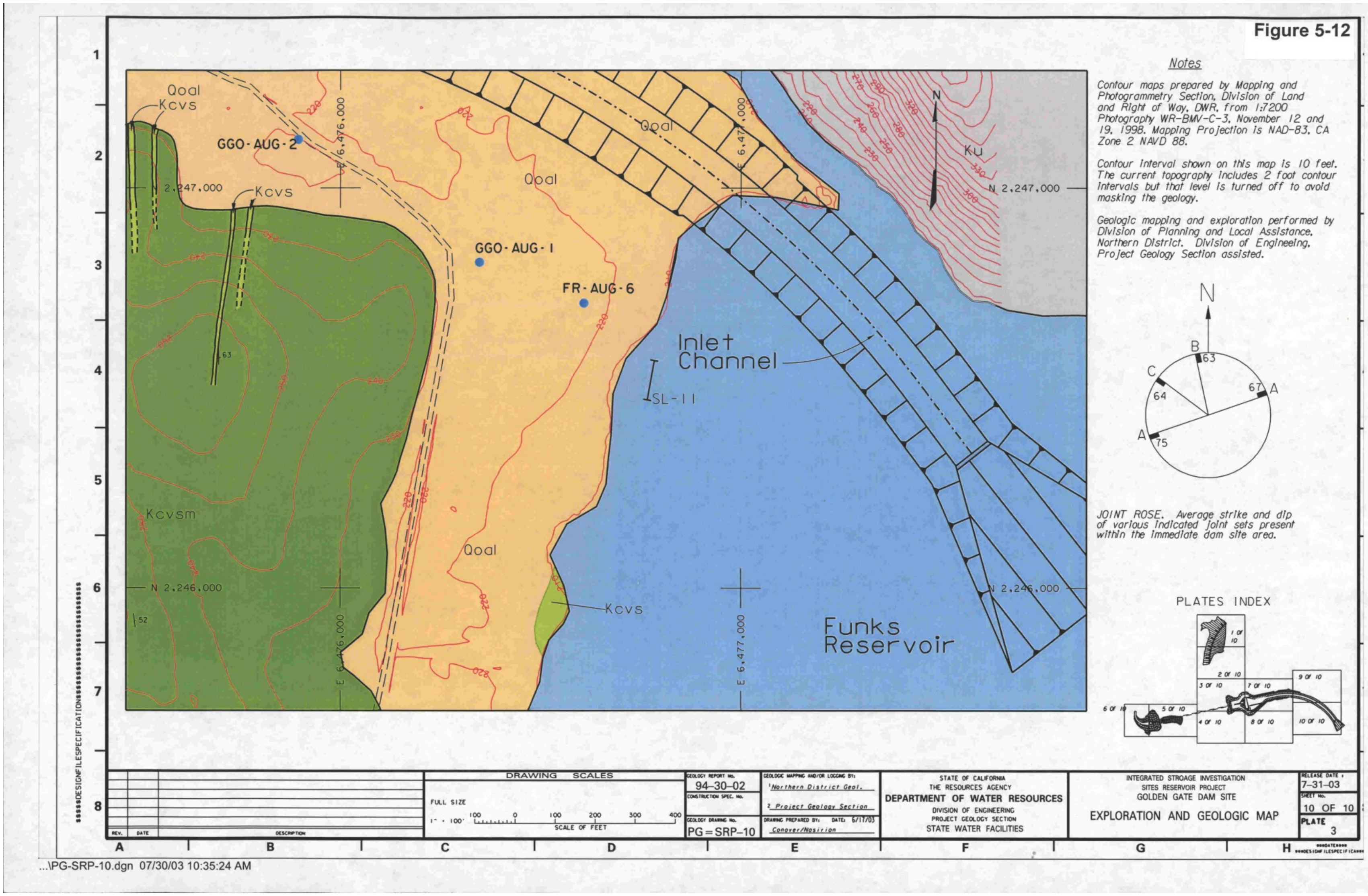

Figure B.2-16. Golden Gate Dam Site – Exploration and Geologic Map (Sheet 3)

Figure B.2-17. Golden Gate Dam Site – Exploration and Geologic Map (Sheet 4)

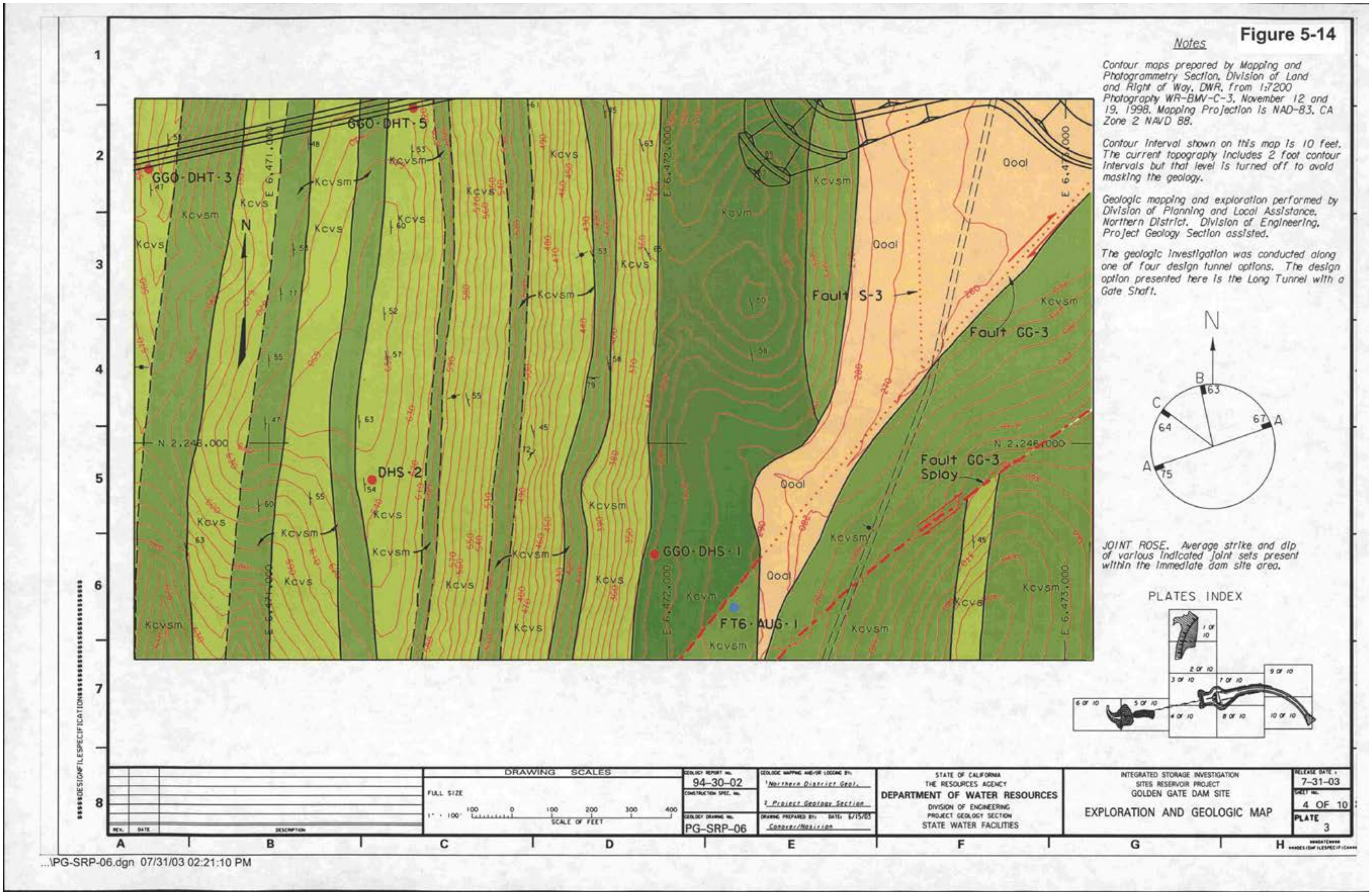

Figure B.2-18. Golden Gate Dam Site – Exploration and Geologic Map (Sheet 5)

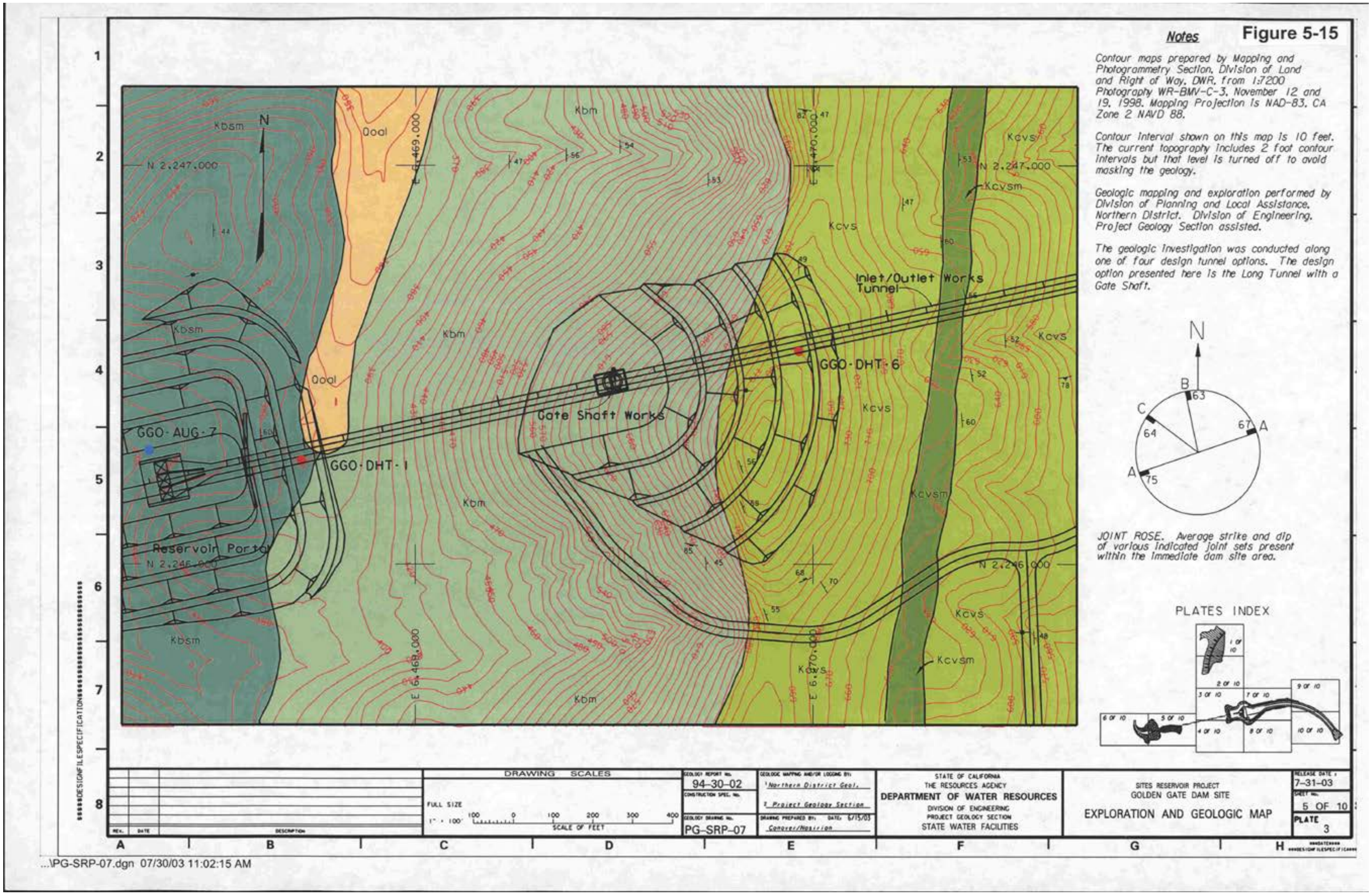

Figure B.2-19. Golden Gate Dam Site – Exploration and Geologic Map (Sheet 6)