



**US Army Corps
of Engineers®**
Walla Walla District



**United States
Environmental Protection Agency
Region 10**

DREDGED MATERIAL MANAGEMENT PLAN AND ENVIRONMENTAL IMPACT STATEMENT

McNary Reservoir and Lower Snake River Reservoirs

APPENDIX E Levee Modification/Extension Analysis

**DRAFT
October 2001**

**FINAL
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**FINAL DREDGED MATERIAL MANAGEMENT PLAN AND
ENVIRONMENTAL IMPACT STATEMENT
McNary Reservoir and Lower Snake River Reservoirs**

JULY 2002

**ERRATA SHEET
FOR
APPENDIX E - LEVEE MODIFICATION/EXTENSION ANALYSIS**

This appendix has not been substantially changed from the draft and will not be reprinted. Please make the following changes to the draft appendix and consider the draft appendix with corrections as the final appendix.

Front cover:

Apply the attached label (FINAL, July 2002) on the front cover to the right of the draft date.

Footnotes throughout the appendix:

Change all footnote references from "Draft DMMP/EIS, October 2001" to "Final DMMP/EIS, July 2002."

Page E-2, Table E-1-1

The table should include the following note: Access to Highway 129 and Snake River Road would be required for the proposed three-foot levee raise.

*** * * END OF CHANGES * * ***

**DREDGED MATERIAL MANAGEMENT PLAN
AND ENVIRONMENTAL IMPACT STATEMENT**

MCNARY RESERVOIR AND LOWER SNAKE RIVER RESERVOIRS

APPENDIX E

LEVEE MODIFICATION/EXTENSION ANALYSIS

**U.S. Army Corps of Engineers
Walla Walla District
201 N. 3rd Avenue
Walla Walla, WA 99362**

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1.0 STUDY PURPOSE AND SCOPE

The purpose of this study is for the U.S. Army Corps of Engineers (Corps), Walla Walla District (District), to examine the following four different levee modifications considered for the Lewiston, Idaho, and Clarkston and Asotin, Washington, areas.

- Raise levees 12 feet [3.7 meters (m)]
- Raise levees 8 feet (2.4 m)
- Raise levees 4 feet (1.2 m)
- Raise levees 3 feet (0.9 m)

The computed levee raises and impacts to other facilities were determined from computed river water surface profiles and are dependent upon the location in the reservoir. The tops of levees and raises for the roads and railroad were matched to the water surface profiles. Freeboard was not considered. Instead, a risk-based analysis was employed to determine levee heights (see appendix C, Economic Analysis). It was assumed that there would not be flooding impacts upstream of the Lewiston water intake on the Clearwater River and upstream of Asotin on the Snake River. The water surface profiles showed negligible change to the normal pool elevations downstream of Chief Timothy State Park on the Snake River. Table E-1-1, Levee Raise Matrix, provides a matrix of the facilities considered to be at risk for flooding impact.

Table E-1-1. Levee Raise Matrix.

Protect	Flood/Cleanup	Flood Fight Measures
City of Lewiston	Hells Canyon Resort Marina	Rooster's Landing Restaurant
City of Clarkston	Marginal Land along Rivers	Hellsgate Store and Restaurant
City of Asotin	Chief Timothy State Park	US Forest Service Building (at Swallows Park)
Port of Lewiston	Hellsgate State Park	Corps Clarkston Resource Office
Port of Clarkston	Private Property Below Asotin	Golf Course Private Residences
Port of Wilma	Swallows Park	Homes and Businesses* (along Highway 129)
Lewiston Water Intake	Clarkston Country Club Golf Course	
Lewiston Treatment Plant	Southway Boat Ramp	
Asotin Treatment Plant	Corps Resource Office Boat Ramp	
Clarkston Sewage Treatment	Bike and Walking Trails (along Highway 129)	
CPRR		
Highway 12		
Highway 129		
Snake River Avenue		
Snake River Road		
County Road 900		
Red Wolf Bridge Access		
Interstate Bridge		
Memorial Bridge		
CPRR Bridge		
Asotin Bridges (two)		

* Acquisition required for 8- and 12-foot (2.4- and 3.7-m) raises.

2.0 BACKGROUND

The Lower Granite Lock and Dam (Lower Granite) is the most upstream of the four lower Snake River dams and is the final link in the inland waterway system that provides slackwater navigation to the cities of Lewiston and Clarkston. The upper reach of the Lower Granite reservoir serves as a sediment trap for most of the material carried in suspension in the free-flowing reaches of the upstream rivers. The Lower Granite reservoir is further bound by the location of the cities of Lewiston and Clarkston. The Lower Granite project includes a backwater levee system installed in lieu of relocating the business district of Lewiston. This levee system was not designed for the purpose of providing flood control to the city. Rather, the levee system can be thought of as an upstream extension of the dam. The levees were designed to allow the Lower Granite reservoir to be maintained at the normal operating elevation and protect Lewiston from inundation during a standard project flood.

Sediment accumulation in the reservoir has reduced the level of protection provided by the levees. Less than 3 feet (0.9 m) of the originally designed 5 feet (1.5 m) of levee freeboard remain for the standard project flood. Historically, the Corps has dredged material from the Snake and Clearwater Rivers in the confluence area to reduce projected water surface profiles at the levee system during high-flow events. The question of dredging the reservoir versus raising the levees is one that this study will help answer. This study examines the impacts for allowing the reservoir elevation to rise. Other studies, outside the scope of this report, are examining the costs and impacts for dredging the reservoir.

3.0 ALTERNATIVES

3.1 Levees

3.1.1 General

The four raises [3, 4, 8, and 12 feet (0.9, 1.2, 2.4, and 3.7 m)] are approximate raises for the river profiles and are based on a nominal raise at a point at the confluence. From that point, new levee profiles were computed from the river profiles. The subsequent raises at the levees, and other features, are generally less than that required at the confluence depending on the River Mile (RM) location and topography. The plates at the end of this appendix show the locations for each type of raise.

3.1.1.1 Bin Wall Raise

A “bin wall” type of raise was selected for some areas rather than the earth embankment, because it does not change the existing footprint of the levee. Therefore, the existing drainage systems are not affected, including the collection ditches, pipes, ponds, and the pump plants. There are various types of retaining walls that could be used to form the “bin wall.” A reinforced earth retaining wall was selected for this study, because it is very versatile for both engineering and visual considerations. A reinforced earth wall has also been used to raise a dam under very similar conditions. The wall could be built with vertical faces, but for aesthetic reasons, the walls were assumed to be terraced with 1-foot (0.3-m) setbacks for each 2-foot (0.6-m) raise. The face panels would be 2 feet (0.6 m) high and 10 to 12 feet (3.1 to 3.7 m) long. Reinforcing straps would extend into the backfill but will not need to connect to the opposing wall panel. Backfill will consist of gravel with 20 to 30 percent fines that will provide a strong material that is relatively impervious. The top of the existing levee will have to be excavated 4 feet (1.2 m) to accommodate the wider base for terracing the walls. The excavation depth will decrease as the wall heights decrease, but a minimum of 1 foot (0.3 m) of excavation will be required to tie the new construction to the existing impervious core. The final raise will have a 12-foot (3.7-m) top width with guardrails (plate E-33).

3.1.1.2 Earth Embankment Raise

For areas that do not need the “bin wall” type of construction, an earth embankment raise was employed. Impervious gravel (gravel with 20 to 30 percent fines) would be placed above the existing impervious core and filter. The footprint of the levee will extend back to the landside

using gravel backfill. The existing 12-foot (3.7-m) top width will be maintained. The top of the existing levee will first be excavated to the impervious core and filter to allow the new impervious gravel backfill to tie to the existing core and filter. The slopes were generally determined to be 1 vertical (v) to 2 horizontal (h). However, the backslope could be flatter. In areas or conditions that require a 2-foot (0.6-m) or less raise, the extended levee slopes would be steepened to 1v to 1.5h providing the additional levee height without changing the footprint or impacting adjacent facilities (plate E-33).

3.1.1.3 New Levees

Where new levees are required, they will be constructed of impervious gravel (20 to 30 percent fines). Generally, 1v to 2h slopes will be used with flatter backslopes to accommodate local conditions. A 12-foot (3.7-m) top width is provided for access and maintenance. Since all new levees will have water on them only infrequently, no foundation cutoffs are planned. Foundation preparation will consist of excavating the first 1 to 2 feet (0.3 to 0.6 m) of foundation before embankment material is placed. Culverts through the new levees will accommodate natural drainage. During high flows, flap gates or manually operated gate valves will control the river from flowing into the culverts.

3.1.1.4 Levee Utilities

The sewer lines, water lines, gas lines, pump discharge pipes, and siphons now cross over the top of the existing levees. These lines will not be changed with the new construction. Construction of any levee raise will take place above the existing pipes without disturbing them. Raising the levees will increase the depth of these pipes, but access will still be out of the pool except during high river flows. The West Lewiston Levee has extensive irrigation lines and buried power lines for levee lighting. The power lines and some of the irrigation lines will be disrupted during the construction of a levee raise and will have to be reconstructed.

3.1.1.5 Levee Pump Plants

The levee raises were designed to have zero to minimal impact on the four levee pump plants. During high flows, pump efficiency will be reduced because of the higher head, but this is a very short and infrequent condition and should not require any kind of an upgrade in pumping capacity. With a higher reservoir, a back siphon condition can develop. However, this would be very infrequent and if this developed, the pumps would cycle on and reverse the siphon action. The Potlatch Corporation water intake will not be impacted by a higher reservoir.

3.1.1.6 Drainage Structures

The two drainage structures, Lindsey Creek and 380 Outlet, are gated structures. If a flood event raised the reservoir to the point where the reservoir was flowing through them, the gates would be closed. No changes to these structures are planned.

3.1.2 West Lewiston Levee

- **12-foot (3.7-m) Raise** - The West Lewiston Levee will be raised using a “bin wall” type construction. The wall height will vary from 9 feet (2.7 m), at the Snake River tie-in, to slightly less than 12 feet (3.7 m) at the confluence of the Snake and Clearwater Rivers. The wall height reduces as the levee travels toward Memorial Bridge. The current Snake River tie-in at RM 140.5 does not change except to become higher in elevation.
- **8-foot (2.4-m) Raise** - A “bin wall” raise was planned varying from 5 feet (1.5 m) in height to slightly less than 8 feet (2.4 m) at the confluence of the two rivers. Excavation of the top of the existing levee decreases, because the lower raise does not need as wide a base.
- **4-foot (1.2-m) Raise** - A “bin wall” raise will be used varying in height from 1 foot (0.3 m) to slightly less than 4 feet (1.2 m). The raise ends at Memorial Bridge. No earth embankment is planned.
- **3-foot (0.9-m) Raise** - An earth embankment with a maximum height of 1.5 feet (0.5 m) is needed. The raise extends from the Snake River tie-in to just upstream of the Camas Prairie Railroad (CPRR) Bridge.

3.1.3 East Lewiston Levee

- **12-foot (3.7-m) Raise** - The “bin wall” raise will continue upstream of the Memorial Bridge to the Potlatch Corporation water intake. From this point, the levee will be raised using an earth embankment. The slope of the landside was planned at 1v to 2h. This slope could be flatter to accommodate Potlatch and their operations. Some Potlatch buildings that are now on Corps land will have to be moved. As originally agreed by Potlatch, this should be done at no cost to the Government. At the most upstream end of the levee, the raise is very minor and the slopes will be steepened to 1v to 1.5h to avoid the large Potlatch building. The levee end will extend a short distance beyond the existing tie-in.
- **8-foot (2.4-m) Raise** - From the Memorial Bridge, the “bin wall” raise continues from the West Lewiston Levee to Potlatch Corporation’s water intake. The raise would not extend beyond the water intake.
- **4-foot (1.2-m) Raise** - No raise is required.
- **3-foot (0.9-m) Raise** - No raise is required.

3.1.4 North Lewiston Levee

- **12-foot (3.7-m) Raise** - An earth embankment raise will be used for the downstream end of the North Lewiston Levee from Pump Plant A through the Port of Lewiston. A slope of 1v to 4h was planned for the landside slope to accommodate port operations. A “bin

wall” raise will be used from the downstream tie-in to the pump plant and from the end of the Port of Lewiston to the upstream tie-in. These areas have open drainage ditches and the two pump plants, which will not have to be rebuilt if the “bin wall” raise is used. The new upstream tie-in extends a short distance from the existing tie-in.

- **8-foot (2.4-m) Raise** - The sections of the levee that have open drain ditches and pump plants will have a “bin wall” type raise. The section by the Port of Lewiston will have an earth embankment with a flatter landside slope (1v to 4h) to support port operations. The maximum raise is 5.5 feet (1.7 m).
- **4-foot (1.2-m) Raise** - An earth embankment varying in height from 1 foot (0.3 m) to slightly less than 2 feet (0.6 m) is planned. No “bin wall” is needed.
- **3-foot (0.9-m) Raise** - No raise is required.

3.1.5 New Asotin Levee

- **12-foot (3.7-m) Raise** - A new levee is required for the city of Asotin. Starting at Asotin Creek and following the river shoreline to natural high ground upstream of the city, the levee will vary in height from 6 to 12 feet (1.8 to 3.7 m) for 2 miles [3.2 kilometers (km)].
- **8-foot (2.4-m) Raise** - The city of Asotin will again need a 2-mile (3.2-km) levee. It will vary from 4 to 10 feet (1.2 to 3.1 m) in height.
- **4-foot (1.2-m) Raise** - No levee required. The topography drops toward the river and a 4-foot (1.2-m) raise does not increase river elevations sufficiently to require a new levee.
- **3-foot (0.9-m) Raise** - No levee required.

3.2 Roads

3.2.1 Highway 12

Highway 12 will be raised from downstream of Chief Timothy State Park to the Red Wolf Bridge. The highway raise will keep the existing centerline alignment. The pavement section will meet present state design standards.

- **12-foot (3.7-m) Raise** - The highway raise will vary between 4 and 7 feet (1.2 and 2.1 m). The length of raise is approximately 7 miles (11.3 km).
- **8-foot (2.4-m) Raise** - Highway 12 raise will vary between 2 and 4 feet (0.6 and 1.2 m) for approximately 3 miles (4.8 km).
- **4-foot (1.2-m) Raise** - There are no changes to the existing highway.

- **3-foot (0.9-m) Raise** - No change to the existing highway.

3.2.2 County Road 900

County Road 900 on the north side of the Snake River just below the confluence will be raised from approximately RM 138 to RM 139. The road centerline will be moved 8 feet (2.4 m) to the north of the existing centerline alignment for the 12-foot (3.7-m) raise; however, the road raise will keep the existing centerline alignment for the 8-foot (2.4-m) raise. The pavement section will meet present state design standards.

- **12-foot (3.7-m) Raise** - The county road is raised 6 feet (1.8 m). The length of raise is approximately 1 mile (1.6 km).
- **8-foot (2.4-m) Raise** - County Road 900 will be raised 2 feet (0.6 m) for 1 mile (1.6 km).
- **4-foot (1.2-m) Raise** - There are no changes to the existing road.
- **3-foot (0.9-m) Raise** - There are no changes to the existing road.

3.2.3 Highway 129

Highway 129 on the west side of the Snake River upstream from Clarkston will be raised from approximately RM 141 to RM 145.5. The highway raise will keep the existing centerline alignment. The pavement section will meet present state design standards.

- **12-foot (3.7-m) Raise** - The highway raise will vary between 2 and 12 feet (0.6 and 3.7 m). The length of raise is approximately 3.5 miles (5.63 km).
- **8-foot (2.4-m) Raise** - Highway 129 raise will vary between 2 and 8 feet (0.6 and 2.4 m) for approximately 2.5 miles (4.02 km).
- **4-foot (1.2-m) Raise** - The raise will vary between 2 and 4 feet (0.6 and 1.2 m) for approximately 1.5 miles (2.41 km).
- **3-foot (0.9-m) Raise** - Highway 129 will be raised 3 feet (0.9 m) for approximately 1 mile (1.6 km).

3.2.4 Red Wolf Bridge Access

For the 12-foot (3.7-m) raise only, the access road to the Red Wolf Bridge will be raised approximately 2,000 feet (609.6 m). The access road raise will keep the existing centerline alignment. The pavement section will meet present state design standards.

- **12-foot (3.7-m) Raise** - The access road raise will be 7 feet (2.1 m).

- **8-foot (2.4-m) Raise** - No changes are required. The topography riverside of the road is higher than the existing road and will protect the road for this raise.
- **4-foot (1.2-m) Raise** - No changes are required.
- **3-foot (0.9-m) Raise** - No changes are required.

3.2.5 Snake River Avenue

Snake River Avenue will be raised from the end of the West Lewiston Levee to the Lewiston-Clarkston Bridge. The highway raise will keep the existing centerline alignment.

- **12-foot (3.7-m) Raise** - The avenue will be raised 8 feet (2.4 m). The length of raise is approximately 0.8 mile (1.29 km).
- **8-foot (2.4-m) Raise** - Snake River Avenue will be raised 4 feet (1.2 m) for approximately 0.8 mile (1.29 km).
- **4-foot (1.2-m) Raise** - There are no changes to the existing road.
- **3-foot (0.9-m) Raise** - There are no changes to the existing road.

3.2.6 Snake River Road above Asotin

Snake River Road above Asotin will be raised starting at RM 147. The road raise will keep the existing centerline alignment. The pavement section will meet present state design standards.

- **12-foot (3.7-m) Raise** - Snake River Road above Asotin will be raised 10 feet (3.1 m) for approximately 0.2 mile (0.3 km).
- **8-foot (2.4-m) Raise** - The road will be raised 6 feet (1.8 m). The length of raise is approximately 0.2 mile (0.3 km).
- **4-foot (1.2-m) Raise** - The road will be raised 2 feet (0.6 m). The length of raise is approximately 0.2 mile (0.3 km).
- **3-foot (0.9-m) Raise** - The road will be raised 1 foot (0.3 m). The length of raise is approximately 0.2 mile (0.3 km).

3.3 Utilities

3.3.1 Clarkston Sewage Treatment Plant

The Clarkston Sewage Treatment Plant has to be protected for the 12-foot (3.7-m) raise. A new levee with a maximum height of 6 feet (1.8 m) is proposed. The levee is short, approximately 1,000 feet (304.8 m) long and is needed only for the 12-foot (3.7-m) raise. The treatment plant is above the 8-foot (2.4-m) raise water surface profile and does not require levee protection for the

other raises. It is anticipated that for the 12-foot (3.7-m) raise water surface profile, the Clarkston Sewage Treatment Plant would be required to pump the treated effluent to the river.

3.3.2 Asotin Sewage Treatment Plant

The Asotin Sewage Treatment Plant for the city of Asotin will require a levee for the 12- and 8-foot (3.7- and 2.4-m) raises. The new levee will start at Asotin Creek and tie-in to Highway 129 downstream of the plant. Maximum levee height is 12 feet (3.7 m) for the 12-foot (3.7-m) raise and 10 feet (3.1 m) for the 8-foot (2.4-m) raise. For the 12- and 8-foot (3.7- and 2.4-m) raise water surface profiles, the Asotin Sewage Treatment Plant would be required to pump the treated effluent to the river. Costs for additional pumping capacity are included in the estimate.

3.3.3 Lewiston Sewage Treatment Plant

The North Lewiston Levee protects the Lewiston Sewage Treatment Plant. However, with an increase in reservoir elevation, pumping will be required for the effluent. Pumping costs have been included for the 12- and 8-foot (3.7- and 2.4-m) raise. The other raises do not affect the facility.

3.3.4 Lewiston Water Intake

The 12-foot (3.7-m) raise affects the Lewiston water intake on the Clearwater River. A 2-foot-high (0.6-m-high) concrete wall is proposed to protect the intake. The facility is above backwater effects for the other raises.

3.4 Bridges

3.4.1 Interstate Bridge

The Interstate Bridge carries four lanes of U.S. 12 over the Snake River between Lewiston and Clarkston. The bridge was constructed in 1939 and consists of a central 200-foot (61.0-m) steel truss lift-span, two adjacent 150-foot (45.7-m) steel truss tower spans, and monolithic reinforced concrete approach spans from the east and west. The bridge is maintained by the Washington State Department of Transportation. It is unlikely that the bridge will require replacement before levee modifications are made.

The Interstate Bridge will require raising for the 4-, 8-, and 12-foot (1.2-, 2.4-, and 3.7-m) levee raise alternatives. The monolithic approach spans will have to be replaced because it will be impractical to sawcut and use hydraulic jacks to raise the approaches to the required level. Existing concrete approaches will be demolished and replaced with prestressed concrete girders and a cast-in-place concrete bridge deck.

The steel lift span and its adjacent truss spans, which are supported by concrete piers, may be raised. The raise of each truss will be accomplished by using eight 200-ton (181-metric ton) hydraulic jacks. The jacking height at each pier must not be greater than 2 feet (0.6 m) before

the pier additions are poured. The bridge will be supported on shims of steel grillage between the 2-foot (0.6-m) additions.

Increasing the grade of the concrete approach spans will minimize changes to the approach grades. Traffic over the Interstate Bridge will be prohibited throughout the entire modification process. Traffic will be detoured over the Red Wolf Bridge or the Southway Bridge.

3.4.2 The CPRR Bridge

The CPRR Bridge carries a single track of rail traffic over the Clearwater River just upstream from its confluence with the Snake River. The bridge was constructed in 1908 and originally consisted of five 150-foot (45.7-m) fixed steel truss spans and one 240-foot (73.2-m) steel truss swing-span. As part of the Lower Granite construction, the bridge was raised 9 feet (2.7 m), and two of the 150-foot (45.7-m) spans were replaced with a 240-foot (73.2-m) lift span and two 30-foot (9.1-m) lift spans. Additionally, one of the 150-foot (45.7-m) trusses was replaced with a 65-foot (19.8-m) steel through plate girder approach span. Although portions of the bridge were constructed in 1908, complete replacement of the bridge is unlikely because the lift portions of the bridge were constructed in 1975.

The CPRR Bridge will require raising for the 4-, 8-, and 12-foot (1.2-, 2.4-, and 3.7-m) levee raise alternatives. The bridge may be raised in a method similar to the method used in the 1975 bridge raise. The entire bridge will be raised in 8-inch (20.3-centimeters) lifts and shimmed with steel grillage between each lift. A total of thirty 200-ton (181-metric ton) jacks will be required to lift the entire bridge at one time. The jacking height at each pier must not be greater than 2 feet (0.6 m) before the pier additions are poured.

There are no viable detour routes for the rail traffic. The rail traffic is not very frequent and may not require interruption if each lift cycle and approach grade reconstruction were accomplished within a 16-hour time period. The line was kept in operation in 1975 with a similar lifting sequence.

In addition to raising the bridge superstructure, both approach grades to the bridge must be modified. The grade to the bridge must be kept at a maximum of 1 percent because the line is used for freight traffic. Additional fill material must be added to the existing ballast. Additions to the abutment backwalls and wingwalls will also be required.

3.4.3 Memorial Bridge

The Memorial Bridge carries four lanes of U.S. 12 over the Clearwater River between Lewiston and North Lewiston. The bridge was constructed in 1946, and is a variable depth, riveted steel plate girder bridge. Loads from the steel superstructure are transferred to the concrete substructure through steel rocker and pin bearings. The bridge has 12 spans that are divided into 3-span units between expansion joints. In each unit, three of the bearings are expansion bearings and one bearing is a pinned bearing. There are six longitudinal steel girders. A longitudinal expansion joint at the centerline of the structure runs the length of the bridge. Traffic under the bridge is limited to small craft due to the low vertical clearance.

The south end of the bridge has satisfactory clearance for all levels of levee raises. The north end of the bridge will require raising for the 4-, 8-, and 12-foot (1.2-, 2.4-, and 3.7-m) levee raise alternatives. The existing bridge has a constant grade down from the south abutment towards the north abutment. Because of this constant grade, the different level of required bridge raises will be accomplished by raising the north abutment the required amount and varying the raise at each pier until no raise is required at the south abutment. For example: a 12-foot (3.7-m) raise at the north abutment will require an 11-foot (3.35-m) raise at Pier 11; a 10-foot (3.1-m) raise at Pier 10; a 9-foot raise (2.7-m) at Pier 9, a 1-foot (0.3-m) raise at Pier 1, and a no raise at the south abutment.

The raises at each pier will be accomplished by using 200-ton (181-metric ton) hydraulic jacks at each of the steel bearings. Each three-span unit of the bridge between the expansion joints must be jacked together because of the continuity of the steel girders. The jacking height at each pier must not be greater than 2 feet (0.6 m) before the pier additions are poured. The bridge will be supported on shims of steel grillage between the 2-foot (0.6-m) additions.

The longitudinal expansion joint will allow for construction to occur on one half of the bridge while the other half of the bridge is converted to a two-lane bridge (two-way, single-lane traffic). Traffic on U.S. 12 may also be detoured over the Red Wolf Bridge.

In addition to raising the bridge superstructures, the North Lewiston approach grade to the bridge must be modified. Additional fill material, base, top course, and pavement must be added to the existing grade. Additions to the abutment backwall and wingwalls will also be required.

3.4.4 Asotin Bridges

Both the Asotin Memorial Bridge and the Highway 129-10 Bridge carry two lanes of traffic over Asotin Creek in the city of Asotin. They will both have to be modified for the 4-, 8-, and 12-foot (1.2-, 2.4-, and 3.7-m) levee raise alternatives.

The Asotin Memorial Bridge is an 84-foot (25.6-m) long, 33-foot (10.1-m) wide reinforced concrete arch bridge. It was built as a memorial of those who served in World War I. The Highway 129-10 Bridge is a 111-foot (33.8-m) long, 38-foot (11.6-m) wide, three-span reinforced concrete bridge. It was constructed in 1956.

Both bridges, being of cast-in-place concrete construction, cannot be economically raised and should be demolished and replaced. They will be replaced with bridges constructed with concrete prestressed girders and cast-in-place concrete decks.

In addition to raising the bridge superstructures, the approaches to the bridges must be modified. Additional fill material, base, top course, and pavement must be added to the existing grade. Additions to the abutment backwalls and wingwalls will also be required.

The Asotin Memorial Bridge is located just upstream from the Highway 129-10 Bridge. Baumeister Road connects the north approaches of both bridges, and Cleveland Street connects

the south approaches. Each of the bridges will serve as detour bridges while the other is under construction.

3.4.5 Pedestrian Bridge

The pedestrian bridge provides access across the Lewiston Highway 12 Bypass to the top of the West Lewiston Levee. It consists of a single span over the highway with a stairway approach on one end and a ramp span to the levee.

The modification for the 12- and 8-foot (3.7- and 2.4-m) raises will require removal of the ramp span. The span is constructed of reinforced concrete and cannot be raised. A new span will be constructed of prestressed concrete girder and a poured-in-place deck. No modifications are required for the 4- and 3-foot (1.2- and 0.9-m) raises.

3.5 Railroad Track

3.5.1 North Side of CPRR Bridge

The railroad track will be raised from approximately RM 137.5 to the railroad bridge. The railroad centerline will be moved 8 feet (2.4 m) to the north of the existing centerline alignment for the 12-foot (3.7-m) raise. The railroad raise will keep the existing centerline alignment for the 8-foot (2.4-m) raise.

- **12-foot (3.7-m) Raise** - The railroad track will be raised 5 feet (1.5 m) for approximately 2 miles (3.2 km).
- **8-foot (2.4-m) Raise** - The railroad will be raised 1 foot (0.3 m). The length of raise is approximately 2 miles (3.2 km).
- **4-foot (1.2-m) Raise** - There are no changes to the existing railroad.
- **3-foot (0.9-m) Raise** - There are no changes to the existing railroad.

3.5.2 South Side of CPRR Bridge

The West Lewiston Levee protects the track on the south side of the river. However, the track will have to be raised to match the railroad bridge raise. The railroad track will be raised starting at the railroad bridge extending up the track approximately 600 feet (182.9 m). The railroad raise will keep the existing centerline alignment.

3.6 Ports

Protection of the port facilities is considered essential. The ports are an important part of the local economy. To provide adequate protection, dolphins will be replaced since extensions do not provide an acceptable moorage structure. Moorage cells will be extended, filled, and capped. These cells are for moorage as well as support for loading and handling facilities. Areas that

could be flooded will be protected with a conventional levee or an earthen fill to raise the ground level.

3.6.1 Port of Wilma

The downstream end of the port will require a protective levee with a maximum 12-foot (3.7-m) height. The levee will be of conventional construction using impervious gravel (gravel with 20 to 30 percent fines) with 1v to 2h side slopes and a 12-foot (3.7-m) top width. No foundation cutoff is considered necessary since water will not be on the levee over long periods. A fill is planned for the low area of the wood chipping facility. A random fill of an average of 4 feet (1.2 m) is considered a more appropriate solution than a levee. The fill will better suit the operational needs of the area. Port of Wilma has 24 dolphins that are to be replaced and 4 cells that have to be raised. There are also five overhead loading facilities and a barge tie-up to be modified. The raises for 4 feet (1.2 m) or less do not require work at the port.

3.6.2 Port of Lewiston

A short protective levee will be built to protect the log equipment area. The levee will be an average of 7 feet (2.1 m) high and constructed of impervious gravel. The log deck area will be raised using a random fill averaging 2 feet (0.6 m) in depth. The Port of Lewiston has no dolphins but has 12 cells that are to be extended. There are 10 cells for moorage with 2 supporting the levee loading facilities. Included is raising a large concrete pad that provides the base for a crane for loading and unloading containers. Two grain loading facilities will require modification. The 3-foot (0.9-m) raise will not require work at the Port of Lewiston.

3.6.3 Port of Clarkston

The port has seven dolphins to be replaced and one cell to be raised. A loading facility will require modification and a tour boat landing, having 19 piles for the docks, will be raised. Modifications will be required for the 12- and 8-foot (3.7- and 2.4-m) raises only.

3.7 Recreation Areas

This study concluded that protection of all areas was not necessary nor could it be economically justified. Some areas can be flooded without impacting the public health and safety of the residents or affecting the economy of the Lewiston-Clarkston and Asotin areas. Allowing some flooding requires only that the area be cleaned up of any silt or debris that remains after the high water recedes. The recreation areas at Hellsgate State Park, Swallows Park, and Chief Timothy State Park, as well as the Southway boat ramp, the Corps Clarkston Resource Office boat ramp, and the bike and walking trails are considered floodable. The Hellsgate State Park, Chief Timothy State Park, and Southway boat ramp are owned by the Corps and leased to the State of Idaho, State of Washington, and Nez Perce County, respectively. Swallows Park is owned and maintained by the Corps. The duration of flooding and the areas being affected should not have excessive deposits of sediment. Cleanup will be accomplished by collecting the debris and the sediment removed using pressure water hoses. Restoration of vegetation will be accomplished where required.

3.7.1 Hellsgate State Park

Hellsgate State Park could have a restaurant and convenience store, four rest rooms, and some camping areas flooded. The camping areas will be affected for the 12- and 8-foot (3.7- and 2.4-m) raises only. The restrooms, store, and boat ramp areas will be affected by all levee raises.

3.7.2 Swallows Park

Swallows Park could have two restrooms and the entire day-use area flooded for all levee raises.

3.7.3 Chief Timothy State Park

Chief Timothy State Park could have only a small portion of the beach affected for the 12- and 8-foot (3.7- and 2.4- m) raises. No flooding will occur for the 4- and 3-foot (1.2- and 0.9- m) raises.

3.7.4 Boat Ramps

The Southway boat ramp at the east end of the North Lewiston Levee could require cleanup after flood events for the 12- and 8-foot (3.7- and 2.4- m) levee raise alternatives. The Corps Clarkston Resource Office boat ramp will be flooded in all raise alternatives. The amount of sediment and debris will vary.

3.7.5 Bike and Walking Trails

This will include only the path along Highway 129. In the 12- and 8-foot (3.7- and 2.4-m) raise alternatives, this path could be flooded.

3.7.6 Clarkston Golf and Country Club

The Clarkston Golf and Country Club may have minimal protection from flooding from Highway 12. The highway will be raised using random fill. Constructing the highway as a levee to protect the golf course would not be cost effective. The highway will provide some protection, but being pervious, seepage will occur. For the 12- and 8-foot (3.7- and 2.4- m) raises only, this study considers that sufficient seepage could occur and could reach the river level. This is a conservative approach but considered appropriate for this study. Cleanup would be accomplished using the same procedure as the recreation areas.

3.8 Commercial Buildings

The Rooster's Landing Restaurant, the U.S. Forest Service building at Swallows Park, the convenience store and restaurant at Hellsgate State Park, and the Corps Clarkston Resource Office building would experience flooding. Emergency flood protection measures (i.e., sand-bagging) would be taken to protect these structures. Some cleanup may also be required.

- **12-foot (3.7-m) Raise** - Emergency flood protection measures and possible cleanup at Rooster's Landing Restaurant, the convenience store and restaurant at Hellsgate State Park, the U.S. Forest Service building at Swallows Park, and the Corps Clarkston Resource Office building would be required.
- **8-foot (2.4-m) Raise** - Same as the 12-foot (3.7-m) raise.
- **4-foot (1.2-m) Raise** - Emergency flood protection measures and possible cleanup at the U.S. Forest Service building at Swallows Park and the Corps Clarkston Resource Office building would be required.
- **3-foot (0.9-m) Raise** - Emergency flood protection measures and possible cleanup at the U.S. Forest Service building at Swallows Park and the Corps Clarkston Resource Office building would be required.

3.9 Private Homes

There are 2 private homes on the golf course on the west edge of Clarkston and 12 homes along Highway 129, downstream of Asotin that cannot be effectively protected. A levee to protect the homes on the golf course cannot be tied into high ground without impacting other private property. Highway 129 could be raised under the 12-foot and 8-foot (3.7-m and 2.4-m) alternatives, which could make access to the buildings behind it almost impossible.

- **12-foot (3.7-m) Raise** - Emergency flood protection measures and possible cleanup of the homes on the golf course could be required. The homes along Highway 129 could be purchased with appropriate Congressional authorization and appropriations.
- **8-foot (2.4-m) Raise** - Same as the 12-foot (3.7-m) raise.
- **4-foot (1.2-m) Raise** - No effect.
- **3-foot (0.9-m) Raise** - No effect.

4.0 SLOPE STABILITY

4.1 Existing Levee

To form a comparison of the different types of levee raises, a stability analysis was done on the existing levees. Only the steady seepage condition for the landside slope was analyzed. This condition was considered the only one that was critical. Further analysis should consider a sudden drawdown for the riverside slope. It was not considered for this study, because it is unlikely that with the free draining gravel shells, a sudden drawdown condition will control the design. Material properties used in the analysis are listed in table E-4-1 below. The strength parameters for the impervious core were obtained from the Corps Design Memorandum 29.2. Engineering judgment was used for the other materials. Material weights are saturated weights.

Table E-4-1. Material Properties.

Materials	Weight lbs/ft ³ (kg/M ³)	Phi Angle (Degree)	Cohesion
Impervious Core	120 (1 922)	15	0
Sand Gravel Filter	125 (2 002)	38	0
Gravel Shells	130 (2 082)	45	0
Impervious Gravel	135 (2 162)	42	0

The UTEXAS3 slope stability program was used. The program's search routine for a noncircular failure plane provided the critical safety factor. The computed safety factor for the existing levee is 2.3. This is a high safety factor, but it corresponds to past experience with the levees.

4.2 Earth Embankment Raise

The earth embankment raise was analyzed using an 8-foot (2.4-m) raise since this is the maximum this type of raise will experience. The reservoir elevation was placed at the very top of the new levee height with a corresponding phreatic surface. The levee raise used impervious gravel for the new material properties. The computed safety factor is 1.68.

4.3 Bin Wall Raise

A bin wall with vertical sides, a 12-foot (3.7-m) top width, and filled with impervious gravel was placed on top of the levee. Two conditions were run. The first was the bin wall with no change in the reservoir. The second condition was the bin wall with a reservoir load at the top of the wall and a developed phreatic surface. Table E-4-2 provides a summary of the stability analysis.

Table E-4-2. Stability Analysis Results.

Levee Types	Factor of Safety
Existing Levee	2.3
Earth Embankment with Phreatic Surface	1.68
Bin Wall – No Phreatic Surface	1.85
Bin Wall with Phreatic Surface	1.67

4.4 Levee Failure Issues

4.4.1 Existing Levees

The existing levees are very high quality structures. They are well engineered with high quality construction and are well maintained. They have a 25-year history of excellent performance. In those 25 years, water has been against the levees at maximum or close to maximum reservoir

elevations at all times. The Probable Non-Failure Point (PNP) was determined to be 5 feet (1.5 m) below the crest of the levee. This is the maximum pool elevation and where the levee has a long record of excellent performance. Above this point, the levees have not experienced seepage conditions. The probability of failure for the PNP is assumed to be 0.001 percent. The Probable Failure Point (PFP) was chosen to be 1 foot (0.3 m) below the levee crest. This elevation was selected because the top of the impervious core is 1 foot (0.3 m) below the crest. The probability of failure for the PFP is 15 percent as recommended in Engineer Circular 1110-2-554.

4.4.2 Levee Raises

Both types of levee raises, the bin wall and embankment, use impervious gravel for the new construction. The PNP is the same elevation as the existing levee, 5 feet (1.5 m) below the present levee crest. The probability of failure for the PNP is also the same, 0.001 percent. With the impervious gravel in effect raising the impervious core, the PFP is considered to be 1 foot (0.3 m) below the crest of the raised levee. The probability of failure for the PFP is 15 percent.

4.4.3 New Levees

The proposed new levees have 1v to 2h slopes. A PNP template was assigned with 1v to 3h slopes and a 12-foot (3.7-m) crest width. For an 18-foot (5.5-m) high levee, the PNP is 5 feet (1.5 m) below the crest. For the proposed new levees, the PNP is assumed to be 5 feet (1.5 m) below the levee crest or half way between the levee toe and levee crest, whichever is higher. The probability of failure for the PNP is considered to be 0.01 percent. The PFP is 1 foot (0.3 m) below the crest of the levee and has a probability of failure of 15 percent.

4.4.4 Potential Failure Points

For the modified levees, the most critical seepage zone will be the new impervious zone where it joins the existing levee impervious core. This area is untested and using impervious gravel rather than the impervious silts with protective gravel filters is less conservative. Any potential overtopping should be considered a failure because the levee cannot withstand overtopping without serious erosion. The bin wall will make the levee more resistant to erosion from overtopping but still will not change the levees' potential failure from overtopping.

5.0 BORROW SOURCES

5.1 Gravel Borrow

The source evaluation of gravel material needed for the levee and road raises and the new levees assumed the material would be obtained from the Critchfield Canyon borrow area. It is believed that the material will have sufficient fines to provide the impervious properties needed for the levees without special blending.

5.2 Riprap

Riprap and other rock products, such as railroad ballast, were assumed to be obtained from the Silcott Quarry located next to Highway 12, downstream of Chief Timothy State Park. This quarry has produced excellent quality rock in the past and there are sufficient quantities of rock still available.

6.0 CULTURAL RESOURCE INVESTIGATION

Some of the actions proposed for the levee raise alternatives may affect cultural resources. The potential for affecting cultural resources increases from the minimum potential impact associated with the 3-foot (0.9-m) levee raise to the maximum potential impact associated with the 12-foot (3.7-m) levee raise. There are limitations to the data primarily associated with the age and accuracy of the records. Most of the sites were recorded in the 1960s as cultural resources were inventoried, evaluated, and mitigated before the pool behind Lower Granite filled. At this time, less rigorous documentation of sites was required and, as a consequence, many of the records have poor location information. For this reason, all resources recorded within a distance of 250 feet (76.2 m) from the proposed actions are considered. A second concern is that the identification process may be incomplete and as yet undiscovered sites could be affected by the project. Finally, ethnographic sites should also be considered.

Areas potentially affected include recorded archaeological or historical sites, ethnographic locations, and a few bridges. Based on this level of information, some sites may need to be relocated, along with some of the bridge sites, and would require additional evaluation for eligibility to the NRHP. If determined eligible, project effects will need to be reviewed and additional mitigation measures developed as needed. Four other sites are already recommended as eligible to the NRHP. All will be impacted by raised water levels and may require data recovery excavations as mitigation for project effects.

7.0 REAL ESTATE

The property involved in this study is in the vicinity of Clarkston and Asotin, Washington, and Lewiston, Idaho. Some private property is involved. Some properties are under the jurisdiction of Asotin, Whitman, and Nez Perce counties; the state highway departments of Washington and Idaho; CPRR; and the Ports of Wilma, Lewiston, and Clarkston.

Silcott and Critchfield Road quarries have suitable quality and quantities of material for the levee raising alternatives. They are both located on Corps property.

It appears that sufficient project land is available for the new levee proposed for the city of Asotin. The Corps acquired all of the land riverward of the platted property lines in fee title in the 1970s.

The remaining property for levee extensions; new levees; and raising roads, railroads, and bridges would be obtained by nonprivate agreements with the entity having jurisdiction.

The Clarkston Golf and Country Club could be affected by flooding. The Corps has acquired a flowage easement over most of the property in connection with the Lower Granite project. The two privately owned residences on the golf course may need to be protected with emergency flood control measures. Other properties evaluated for acquisition or protection are the private homes and businesses along Highway 129 at Critchfield Road near Asotin. Commercial property that may require protection include Rooster's Landing Restaurant at Hells Canyon Resort and Marina in Clarkston, the restaurant and convenience store at Hellsgate State Park, the U.S. Forest Service building at Swallows Park, and the Corps Clarkston Resource Office building. All private acquisition costs include survey, appraisal, negotiation closing, and relocation assistance.

The real estate actions for all raises require construction agreements with state and local entities. The 12- and 8-foot (3.7- and 2.4- m) raises require purchase of the Critchfield Road properties. Two private homes on the golf course, the Corps Clarkston Resource Office building, the U.S. Forest Service building at Swallows Park, the Hellsgate store and restaurant, and Rooster's Landing Restaurant would require emergency flood control measures. The 3- and 4-foot (0.9- and 1.2- m) raises would require emergency flood control measures at Rooster's Landing Restaurant [4-foot (1.2- m) raise only], Hellsgate store and restaurant, U.S. Forest Service building, and the Corp's Clarkston Resource Office building.

8.0 COST ESTIMATE

The construction cost estimates were developed from contractor quotations, from previous construction contracts, and engineering judgment. The construction cost estimates considered appropriate for this level of study did not provide separate line item costs for minor items but included them as part of the major construction line items. No line items were included for raising and re-installing guard rail, raising levee lighting, raising irrigation pipes, lengthening culverts, providing culvert gate valves, modifying the bike path adjacent to Highway 129, removing and replacing short concrete walls at the Interstate and Camas Prairie Bridges, and other small peripheral items. Real estate costs were developed from a field survey by a real estate appraiser. The buildings that are estimated for purchase include only the purchase price. Demolition or removal of existing structures would probably be accomplished at no cost to the Government. An archaeologist developed the cultural resource data. Contingencies, engineering and design, and general administration are consistent with common practice for this level of estimate. Cost estimates are provided in the following tables.

Table E-8-1. Construction Cost Estimate. Schedule A: 12-Foot Levee Raise.

Item	Description	Qty	Unit	\$/Unit	Amount
Roads and Railroads					
Highway 129 and Snake River Road					
1	Roadway Fill	620,000	yd ³	\$11.00	\$6,820,000
2	Remove Existing Asphalt Concrete Pavement	54,450	yd ²	\$2.50	\$136,125
3	Asphalt Concrete Pavement	21,900	ton	\$40.00	\$876,000
4	Roadway Crushed Surfacing	54,330	ton	\$10.00	\$543,300
5	Riprap	13,700	yd ³	\$40.00	\$548,000
Snake River Avenue					
1	Roadway Fill	120,000	yd ³	\$11.00	\$1,320,000
2	Remove Existing Asphalt Concrete Pavement	11,110	yd ²	\$2.50	\$27,775
3	Asphalt Concrete Pavement	5,320	ton	\$40.00	\$212,800
4	Roadway Crushed Surfacing	13,690	ton	\$10.00	\$136,900
5	Riprap	3,100	yd ³	\$40.00	\$124,000
CPRR and Highway 900					
1	Roadway Fill	22,450	yd ³	\$11.00	\$246,950
2	Remove Existing Asphalt Concrete Pavement	16,670	yd ²	\$2.50	\$41,675
3	Asphalt Concrete Pavement	5,770	ton	\$35.00	\$201,950
4	Roadway Crushed Surfacing	14,340	ton	\$10.00	\$143,400
5	Railroad Fill	10,000	yd ³	\$7.00	\$70,000
6	Raise Existing RR Track >18 inches	10,560	ft	\$35.00	\$369,600
7	RR Subballast for Raising RR Track > 18 inches	57,000	ton	\$12.00	\$684,000
8	Riprap	3,900	yd ³	\$40.00	\$156,000
Highway 12 and Red Wolf Access Road					
1	Roadway Fill	630,000	yd ³	\$11.00	\$6,930,000
2	Remove Existing Asphalt Concrete Pavement	78,890	yd ²	\$2.50	\$197,225
3	Asphalt Concrete Pavement	39,360	ton	\$40.00	\$1,574,400
4	Roadway Crushed Surfacing	97,790	ton	\$10.00	\$977,900
5	Riprap	15,000	yd ³	\$40.00	\$600,000
Subtotal					\$22,938,000
Contingency 20%					\$4,587,600
Total for Roads and Railroad					\$27,525,600
Levees					
West Lewiston Levee - Snake River above Confluence					
1	Levee Excavation	17,000	yd ³	\$2.50	\$42,500
2	Levee Fill	63,000	yd ³	\$10.00	\$630,000
3	Bin Wall (Surface Area)	130,000	ft ²	\$14.00	\$1,820,000
4	Guardrail	7,400	ft	\$20.00	\$148,000
6	Pave Bike Path	52,000	ft ²	\$2.00	\$104,000
7	Landscaping		LS*	\$100,000.00	\$100,000

Table E-8-1. Construction Cost Estimate. Schedule A: 12-Foot Levee Raise (continued).

Item	Description	Qty	Unit	\$/Unit	Amount
North Lewiston Levee					
1	Levee Excavation	25,000	yd ³	\$2.50	\$62,500
2	Levee Fill	170,000	yd ³	\$10.00	\$1,700,000
3	Levee Riprap	11,000	yd ³	\$40.00	\$440,000
4	Bin Wall (Surface Area)	96,000	ft ²	\$14.00	\$1,344,000
5	Guardrail	6,500	ft	\$20.00	\$130,000
West Lewiston Levee - Clearwater and East Lewiston Levee					
1	Levee Excavation	46,000	yd ³	\$2.50	\$115,000
2	Levee Fill	160,000	yd ³	\$10.00	\$1,600,000
3	Levee Riprap	3,000	yd ³	\$40.00	\$120,000
4	Bin Wall (Surface Area)	400,000	ft ²	\$14.00	\$5,600,000
5	Guardrail	18,000	ft	\$20.00	\$360,000
Asotin City Levee					
1	Levee Excavation	22,000	yd ³	\$2.00	\$44,000
2	Levee Fill	140,600	yd ³	\$10.00	\$1,406,000
3	Riprap	6,100	yd ³	\$40.00	\$244,000
Subtotal					\$16,010,000
Contingency 20%					\$3,202,000
Total for Levees					\$19,212,000
Bridge Raise					
Memorial Bridge					
1	Mobilization @ 10%		LS		\$370,620
2	Jacking Bridge		LS		\$2,742,255
3	Concrete	162	yd ³	\$700.00	\$113,244
4	Structural Steel	280,800	lb	\$3.00	\$842,400
5	Embankment and Backfill	415	yd ³	\$20.00	\$8,300
Subtotal Memorial Bridge					\$4,076,819
Interstate Bridge					
1	Mobilization @ 10%		LS		\$455,944
2	Jacking Bridge		LS		\$1,339,037
3	Concrete Superstructure	41,880	ft ²	\$70.00	\$2,417,714
4	Concrete	530	yd ³	\$700.00	\$370,689
5	Structural Steel	144,000	lb	\$3.00	\$432,000
Subtotal Interstate Bridge					\$5,015,384
Camas Prairie RR Bridge					
1	Mobilization @ 10%		LS		\$373,314
2	Jacking Bridge		LS		\$1,591,117
3	Concrete	1,723	yd ³	\$700.00	\$1,206,022
4	Structural Steel	216,000	lb	\$3.00	\$648,000
5	Embankment and Backfill	14,400	yd ³	\$20.00	\$288,000
Subtotal Camas Prairie RR Bridge					\$4,106,453

Table E-8-1. Construction Cost Estimate. Schedule A: 12-Foot Levee Raise (continued).

Item	Description	Qty	Unit	\$/Unit	Amount
	Asotin Memorial Bridge	1	each	\$315,000.00	\$315,000
	Asotin Highway 129 Bridge	1	each	\$410,000.00	\$410,000
	Pedestrian Bridge	1	each	\$24,700.00	\$24,700
	Subtotal				\$13,948,356
	Contingency 30%				\$4,184,507
	Total Bridges				\$18,132,863
Utilities					
Clarkston Sewage Treatment Plant					
1	Excavation	1,000	yd ³	\$2.00	\$2,000
2	Levee	4,700	yd ³	\$10.00	\$47,000
3	Riprap	450	yd ³	\$40.00	\$18,000
4	New Pumping Capacity	1	each		\$700,000
Asotin Sewage Treatment					
1	Excavation	3,700	yd ³	\$2.00	\$7,400
2	Levee	14,000	yd ³	\$10.00	\$140,000
3	Riprap	1,600	yd ³	\$40.00	\$64,000
4	New Pumping Capacity	1	each		\$255,000
Lewiston Sewage Treatment					
1	New Pumping Capacity	1	each		\$1,140,000
Lewiston Water Intake					
1	Concrete Wall	15	yd ³	\$300.00	\$4,500
	Subtotal				\$2,377,900
	Contingency 20%				\$475,580
	Total Utilities				\$2,853,480
Port Facilities					
Port of Lewiston					
1	Loading Facilities	2	each	\$15,000.00	\$30,000
2	Dolphins				
3	12 Cells	114	ft	\$9,300.00	\$1,060,000
4	Crane Pad	1	each	\$83,000.00	\$83,000
5	Levee	3,000	yd ³	\$7.00	\$21,000
Port of Wilma					
1	Loading Facilities	5	each	\$15,000.00	\$75,000
2	Dolphins	7,128	ft	\$110.00	\$784,080
3	1 Cells	10	ft	\$9,300.00	\$88,350
4	Levee	4,000	yd ³	\$7.00	\$28,000

Table E-8-1. Construction Cost Estimate. Schedule A: 12-Foot Levee Raise (continued).

Item	Description	Qty	Unit	\$/Unit	Amount
Port of Clarkston					
1	Loading Facilities	1	each	\$15,000.00	\$15,000
2	Dolphins	2,079	ft	\$110.00	\$228,690
3	Cells	10	ft	\$9,300.00	\$88,350
4	Boat Dock Piling	180	ft	\$70.00	\$12,600
Subtotal					\$2,514,070
Contingency 20%					\$502,814
Total Port Facilities					\$3,016,884
Recreation Areas					
1	Hellsgate State Park Cleanup	1	each	\$20,000.00	\$20,000
2	Swallows Park Cleanup	1	each	\$15,000.00	\$15,000
3	Chief Timothy Park Cleanup	1	each	\$10,000.00	\$10,000
4	Southway Boat Ramp Cleanup	1	each	\$1,000.00	\$1,000
5	Corps Resource Ramp and Restroom Cleanup	1	each	\$10,000.00	\$10,000
6	Highway 129 Bike Path Cleanup	1	each	\$5,000.00	\$5,000
7	Clarkston Golf Course Cleanup	1	each	\$100,000.00	\$100,000
Subtotal					\$161,000
Contingency 20%					\$32,200
Total Recreation Areas					\$193,200
Floodfight					
Commercial Property					
1	Rooster's Landing Restaurant	1	each	\$20,000.00	\$20,000
2	Hellsgate Store and Restaurant	1	each	\$15,000.00	\$15,000
3	US Forest Service Building at Swallows	1	each	\$15,000.00	\$15,000
4	Corps Clarkston Resource Office	1	each	\$25,000.00	\$25,000
Private Property					
1	Golf Course Residences	2	each	\$20,000.00	\$40,000
Subtotal					\$115,000
Contingency 20%					\$23,000
Total Floodfight					\$138,000
Real Estate					
Private Homes					
1	Critchfield Road Properties (12 Parcels)	1	each	\$1,600,000.00	\$1,600,000
Real Estate Administrative**				\$16,000.00	\$16,000
Subtotal					\$1,616,000
Contingency 20%					\$323,200
Total Real Estate					\$1,939,200
Cultural Resource Investigation					\$40,000

Table E-8-1. Construction Cost Estimate. Schedule A: 12-Foot Levee Raise (continued).

Item	Description	Qty	Unit	\$/Unit	Amount
Subtotal 12-Foot Raise					\$73,051,227
Administration 2%					\$1,461,025
Engineering and Design 13%					\$9,496,659
Construction S&A 5%					\$3,652,561
Total 12-Foot Raise					\$87,661,500

*LS = lump sum.

**Real estate administrative costs are for agreements with local governmental entities.

Table E-8-2. Construction Cost Estimate Schedule B: 8-Foot Levee Raise.

Item	Description	Qty	Unit	\$/Unit	Amount
Roads and Railroads					
Highway 129 and Snake River Road					
1	Roadway Fill	260,000	yd ³	\$11.00	\$2,860,000
2	Remove Existing Asphalt Concrete Pavement	36,670	yd ²	\$2.50	\$91,675
3	Asphalt Concrete Pavement	15,310	ton	\$40.00	\$612,400
4	Roadway Crushed Surfacing	38,030	ton	\$10.00	\$380,300
5	Riprap	6,000	yd ³	\$40.00	\$240,000
Snake River Avenue					
1	Roadway Fill	60,000	yd ³	\$11.00	\$660,000
2	Remove Existing Asphalt Concrete Pavement	11,110	yd ²	\$2.50	\$27,775
3	Asphalt Concrete Pavement	5,320	ton	\$40.00	\$212,800
4	Roadway Crushed Surfacing	13,690	ton	\$10.00	\$136,900
5	Riprap	1,900	yd ³	\$40.00	\$76,000
CPRR and Highway 900					
1	Roadway Fill	12,450	yd ³	\$11.00	\$136,950
2	Remove Existing Asphalt Concrete Pavement	16,670	yd ²	\$2.50	\$41,675
3	Asphalt Concrete Pavement	5,770	ton	\$35.00	\$201,950
4	Roadway Crushed Surfacing	14,340	ton	\$10.00	\$143,400
5	Raise Existing RR Track <12 inches	10,560	ft	\$20.00	\$211,200
6	RR Subballast	38,000	ton	\$10.00	\$380,000
7	Riprap	780	yd ³	\$40.00	\$31,200
Highway 12					
1	Roadway Fill	210,000	yd ³	\$11.00	\$2,310,000
2	Remove Existing Asphalt Concrete Pavement	85,890	yd ²	\$2.50	\$214,725
3	Asphalt Concrete Pavement	29,520	ton	\$40.00	\$1,180,800
4	Roadway Crushed Surfacing	73,340	ton	\$10.00	\$733,400
5	Riprap	5,900	yd ³	\$40.00	\$236,000
Subtotal					\$11,119,150
Contingency 20%					\$2,223,830
Total for Roads and Railroad					\$13,342,980

Table E-8-2. Construction Cost Estimate Schedule B: 8-Foot Levee Raise (continued).

Item	Description	Qty	Unit	\$/Unit	Amount
Levees					
West Lewiston Levee - Snake River above Confluence					
1	Levee Excavation	2,200	yd ³	\$2.50	\$5,500
2	Levee Fill	29,000	yd ³	\$10.00	\$290,000
3	Bin Wall (Surface Area)	28,000	ft ²	\$14.00	\$392,000
4	Guardrail	7,400	ft	\$20.00	\$148,000
5	Pave Bike Path	52,000	ft ²	\$2.00	\$104,000
6	Landscaping		LS*	\$100,000.00	\$100,000
North Lewiston Levee					
1	Levee Excavation	14,000	yd ³	\$2.50	\$35,000
2	Levee Fill	120,000	yd ³	\$10.00	\$1,200,000
3	Bin Wall (Surface Area)	63,200	ft ²	\$14.00	\$884,800
4	Levee Riprap	6,500	yd ³	\$40.00	\$260,000
5	Guardrail	6,000	ft	\$20.00	\$120,000
West Lewiston Levee - Clearwater and East Lewiston Levee					
1	Levee Excavation	18,000	yd ³	\$2.50	\$45,000
2	Levee Fill	53,000	yd ³	\$10.00	\$530,000
3	Bin Wall (Surface Area)	200,000	ft ²	\$14.00	\$2,800,000
4	Guardrail	17,000	ft	\$20.00	\$340,000
Asotin City Levee					
1	Levee Excavation	16,800	yd ³	\$2.00	\$33,600
2	Levee Fill	80,800	yd ³	\$10.00	\$808,000
3	Riprap	4,770	yd ³	\$40.00	\$190,800
Subtotal					\$8,286,700
Contingency 20%					\$1,657,340
Total for Levees					\$9,944,040
Bridge Raise					
Memorial Bridge					
1	Mobilization @ 10%		LS		\$249,827
2	Jacking Bridge		LS		\$1,852,875
3	Concrete	108	yd ³	\$700.00	\$75,496
4	Structural Steel	187,200	lb	\$3.00	\$561,600
5	Embankment and Backfill	415	yd ³	\$20.00	\$5,300
Subtotal Memorial Bridge					\$2,745,098
Interstate Bridge					
1	Mobilization @ 10%		LS		\$331,785
2	Jacking Bridge		LS		\$989,723
3	Concrete Superstructure	41,880	ft ²	\$70.00	\$1,787,006
4	Concrete	353	yd ³	\$700.00	\$247,126
5	Structural Steel	96,000	lb	\$3.00	\$288,000
Subtotal Interstate Bridge					\$3,643,640

Table E-8-2. Construction Cost Estimate Schedule B: 8-Foot Levee Raise (continued).

Item	Description	Qty	Unit	\$/Unit	Amount
Camas Prairie RR Bridge					
1	Mobilization @ 10%		LS		\$264,688
2	Jacking Bridge		LS		\$1,301,823
3	Concrete	1,149	yd ³	\$700.00	\$804,015
4	Structural Steel	144,000	lb	\$3.00	\$432,000
5	Embankment and Backfill	5,452	yd ³	\$20.00	\$109,040
	Subtotal Camas Prairie RR Bridge				\$2,911,566
	Asotin Memorial Bridge	1	each	\$306,000.00	\$306,000
	Asotin Highway 129 Bridge	1	each	\$401,000.00	\$401,000
	Pedestrian Bridge	1	each	\$24,700.00	\$24,700
	Subtotal				\$10,032,004
	Contingency 30%				\$3,009,601
	Total Bridges				\$13,041,605
Utilities					
Asotin Sewage Treatment					
1	Excavation	2,400	yd ³	\$2.00	\$4,800
2	Levee	6,800	yd ³	\$7.00	\$47,600
3	Riprap	1,100	yd ³	\$40.00	\$44,000
4	New Pumping Capacity		LS		\$208,000
	Subtotal				\$1,374,400
	Contingency 20%				\$274,880
	Total Utilities				\$1,649,280
Port Facilities					
Port of Lewiston					
1	Loading Facilities	2	each	\$10,000.00	\$20,000
2	Dolphins [0]				\$0
3	12 Cells	66	ft	\$9,300.00	\$613,800
4	Container Crane Pad	1	each	\$71,000.00	\$71,000
	Subtotal				\$704,800
	Contingency 20%				\$140,960
	Total Port of Lewiston				\$845,760
Port of Wilma					
1	Loading Facilities	5	each	\$10,000.00	\$50,000
2	Dolphins	6,552	ft	\$110.00	\$720,720
3	1 Cell	6	ft	\$9,300.00	\$51,150
	Subtotal				\$821,870
	Contingency 20%				\$164,374
	Total Port of Wilma				\$986,244
Port of Clarkston					
1	Loading Facilities	1	each	\$10,000.00	\$10,000
2	Dolphins	1,911	ft	\$110.00	\$210,200
3	Cells	6	ft	\$9,300.00	\$88,400
4	Boat Dock Piling	105	ft	\$70.00	\$7,300
	Subtotal				\$215,900
	Contingency 20%				\$43,180
	Total Port of Clarkston				\$259,080
	Total Port Facilities				\$2,211,084

Table E-8-2. Construction Cost Estimate Schedule B: 8-Foot Levee Raise (continued).

Item	Description	Qty	Unit	\$/Unit	Amount
Recreation Areas					
1	Hellsgate State Park Cleanup	1	each	\$20,000.00	\$20,000
2	Swallows Park Cleanup	1	each	\$15,000.00	\$15,000
3	Chief Timothy Park Cleanup	1	each	\$10,000.00	\$10,000
4	Southway Boat Ramp Cleanup	1	each	\$1,000.00	\$1,000
5	Corps Resource Ramp and Restroom Cleanup	1	each	\$10,000.00	\$10,000
6	Highway 129 Bike Path Cleanup	1	each	\$5,000.00	\$5,000
7	Clarkston Golf Course Cleanup	1	each	\$100,000.00	\$100,000
Subtotal					\$161,000
Contingency 20%					\$32,200
Total Recreation Areas					\$193,200
Floodfight					
Commercial Property					
1	Rooster's Landing Restaurant	1	each	\$20,000.00	\$20,000
2	Hellsgate Store and Restaurant	1	each	\$15,000.00	\$15,000
3	US Forest Service Building at Swallows	1	each	\$15,000.00	\$15,000
4	Corps Clarkston Resource Office	1	each	\$25,000.00	\$25,000
Private Property					
1	Golf Course Residences	2	each	\$20,000.00	\$40,000
Subtotal					\$115,000
Contingency 20%					\$23,000
Total Floodfight					\$138,000
Real Estate					
1	Critchfield Road Properties (12 Parcels)	1	each	\$1,600,000.00	\$1,600,000
Real Estate Administrative**				\$16,000.00	\$16,000
Subtotal					\$1,616,000
Contingency 20%					\$323,200
Total Real Estate					\$1,939,200
Cultural Resource Investigation					\$40,000
Subtotal 8-Foot Raise					\$42,499,389
Administration 2%					\$849,988
Engineering and Design 13%					\$5,524,921
Construction S&A 5%					\$2,124,969
Total 8-Foot Raise					\$50,999,500

*LS = lump sum.

**Real estate administrative costs are for agreements with local governmental entities.

Table E-8-3. Construction Cost Estimate. Schedule C: 4-Foot Levee Raise.

Item	Description	Qty	Unit	\$/Unit	Amount
Roads					
Highway 129 and Snake River Road					
1	Roadway Fill	90,000	yd ³	\$11.00	\$990,000
2	Remove Existing Asphalt Concrete Pavement	23,330	yd ²	\$2.50	\$58,325
3	Asphalt Concrete Pavement	9,510	ton	\$40.00	\$380,400
4	Roadway Crushed Surfacing	23,630	ton	\$10.00	\$236,300
5	Riprap	2,000	yd ³	\$40.00	\$80,000
Subtotal					\$1,745,025
Contingency 20%					\$349,005
Total for Roads					\$2,094,030
Levees					
West Lewiston Levee - Snake River above Confluence					
1	Levee Excavation	4,300	yd ³	\$2.50	\$10,750
2	Levee Fill	10,000	yd ³	\$10.00	\$100,000
3	Bin Wall (Surface Area)	43,000	ft ²	\$14.00	\$602,000
4	Guardrail	6,600	ft	\$20.00	\$132,000
5	Pave Bike Path	52,000	ft ²	\$2.00	\$104,000
6	Landscaping		LS*	\$100,000.00	\$100,000
North Lewiston Levee					
1	Levee Excavation	2,900	yd ³	\$2.50	\$7,250
2	Levee Fill	8,000	yd ³	\$10.00	\$80,000
3	Levee Riprap	1,000	yd ³	\$40.00	\$40,000
West Lewiston Levee - Clearwater					
1	Levee Excavation	2,900	yd ³	\$2.50	\$7,250
2	Levee Fill	8,000	yd ³	\$10.00	\$80,000
3	Bin Wall (Surface Area)	34,000	ft ²	\$14.00	\$476,000
4	Guardrail	6,100	ft	\$20.00	\$122,000
Subtotal					\$1,861,250
Contingency 20%					\$372,250
Total for Levees					\$2,233,500
Bridge Raise					
Memorial Bridge					
1	Mobilization @ 10%		LS		\$158,680
2	Jacking Bridge		LS		\$1,259,955
3	Concrete	54	yd ³	\$700.00	\$37,748
4	Structural Steel	93,600	lb	\$3.00	\$280,800
5	Embankment and Backfill	415	yd ³	\$20.00	\$8,300
Subtotal Memorial Bridge					\$1,745,483

Table E-8-3. Construction Cost Estimate. Schedule C: 4-Foot Levee Raise (continued).

Item	Description	Qty	Unit	\$/Unit	Amount
Interstate Bridge					
1	Mobilization @ 10%		LS		\$206,427
2	Jacking Bridge		LS		\$640,409
3	Concrete Superstructure	41,880	ft ² F	\$70.00	\$1,156,298
4	Concrete	177	yd ³	\$700.00	\$123,563
5	Structural Steel	48,000	lb	\$3.00	\$144,000
6	Embankment and Backfill		yd ³	\$20.00	
	Subtotal Interstate Bridge				\$2,270,697
Camas Prairie RR					
1	Mobilization @ 10%		LS		\$165,306
2	Jacking Bridge		LS		\$1,012,529
3	Concrete	574	yd ³	\$700.00	\$402,007
4	Structural Steel	72,000	lb	\$3.00	\$216,000
5	Embankment and Backfill	1,126	yd ³	\$20.00	\$22,520
	Subtotal Camas Prairie RR Bridge				\$1,818,362
	Asotin Memorial Bridge	1	each	\$300,000.00	\$300,000
	Asotin Highway 129 Bridge	1	each	\$395,000.00	\$395,000
	Subtotal				\$6,529,542
	Contingency 30%				\$1,958,863
	Total Bridges				\$8,488,405
Port Facilities					
Port of Lewiston					
1	Container Crane Pad	1	each	\$62,000.00	\$62,000
	Contingency 20%				\$12,400
	Total Port Facilities				\$74,400
Recreation Areas					
1	Hellsgate State Park Cleanup	1	each	\$5,000.00	\$5,000
2	Swallows Park Cleanup	1	each	\$10,000.00	\$10,000
3	Corps Resource Ramp and Restroom Cleanup	1	each	\$5,000.00	\$5,000
	Subtotal				\$20,000
	Contingency 20%				\$4,000
	Total Recreation Areas				\$24,000

Table E-8-3. Construction Cost Estimate. Schedule C: 4-Foot Levee Raise (continued).

Item	Description	Qty	Unit	\$/Unit	Amount
Floodfight					
Commercial Property					
1	Rooster's Landing Restaurant	1	each	\$17,000.00	\$17,000
2	Hellsgate Store and Restaurant	1	each	\$12,000.00	\$12,000
3	US Forest Service Building at Swallows	1	each	\$12,000.00	\$12,000
4	Corps Clarkston Resource Office	1	each	\$20,000.00	\$20,000
Subtotal					\$61,000
Contingency 20%					\$12,200
Total Floodfight					\$73,200
Real Estate					
Real Estate Administrative**				\$10,000.00	\$10,000
Subtotal					\$10,000
Contingency 20%					\$2,000
Total Real Estate					\$12,000
Cultural Resource Investigation					\$20,000
Subtotal 4-Foot Raise					\$13,019,535
Administration 2%					\$260,391
Engineering and Design 13%					\$1,692,539
Construction S&A 5%					\$650,977
Total 4-Foot Raise					\$15,623,500

*LS = lump sum.

**Real estate administrative costs are for agreements with local governmental entities.

Table E-8-4. Construction Cost Estimate. Schedule D: 3-Foot Levee Raise.

Item	Description	Qty	Unit	\$/Unit	Amount
Roads					
Highway 129 and Snake River Road					
1	Roadway Fill	50,000	yd ³	\$11.00	\$550,000
2	Remove Existing Asphalt Concrete Pavement	15,560	yd ²	\$2.50	\$38,900
3	Asphalt Concrete Pavement	6,450	ton	\$40.00	\$258,000
4	Roadway Crushed Surfacing	16,030	ton	\$10.00	\$160,300
5	Riprap	1,200	yd ³	\$40.00	\$48,000
Subtotal					\$1,055,200
Contingency 25%					\$263,800
Total for Roads					\$1,319,000
Levees					
West Lewiston Levee - Snake River above Confluence					
1	Levee Excavation	2,200	yd ³	\$2.50	\$5,500
2	Levee Fill	6,100	yd ³	\$10.00	\$61,000
3	Levee Riprap	800	yd ³	\$40.00	\$32,000
4	Pave Bike Path	40,000	ft ²	\$2.00	\$80,000
5	Landscaping		LS*	\$100,000.00	\$100,000
West Lewiston Levee - Clearwater					
1	Levee Excavation	1,300	yd ³	\$2.00	\$2,600
2	Levee Fill	4,600	yd ³	\$10.00	\$46,000
3	Levee Riprap	460	yd ³	\$40.00	\$18,400
Subtotal					\$345,500
Contingency 25%					\$86,375
Total for Levees					\$431,875
Recreation Areas					
1	Hellsgate State Park Cleanup	1	each	\$5,000.00	\$5,000
2	Swallows Park Cleanup	1	each	\$10,000.00	\$10,000
3	Corps Resource Ramp and Restroom Cleanup	1	each	\$5,000.00	\$5,000
Subtotal					\$20,000
Contingency 25%					\$5,000
Total Recreation Areas					\$25,000

Table E-8-4. Construction Cost Estimate. Schedule D: 3-Foot Levee Raise (continued)

Item	Description	Qty	Unit	\$/Unit	Amount
Floodfight					
Commercial Property					
1	Hellsgate Store	1	each	\$12,000.00	\$12,000
2	WSU Building	1	each	\$12,000.00	\$12,000
3	Corps Clarkston Resource Office	1	each	\$20,000.00	\$20,000
Subtotal					\$44,000
Contingency 25%					\$11,000
Total Floodfight					\$55,000
Real Estate					
Real Estate Administrative**				\$10,000.00	\$10,000
Subtotal					\$10,000
Contingency 25%					\$2,500
Total Real Estate					\$12,500
Subtotal 3-Foot Raise					\$1,863,375
Administration 2%					\$37,268
Engineering and Design 15%					\$279,506
Construction S&A 5%					\$93,169
Total 3-Foot Raise					\$2,273,500

*LS = lump sum.

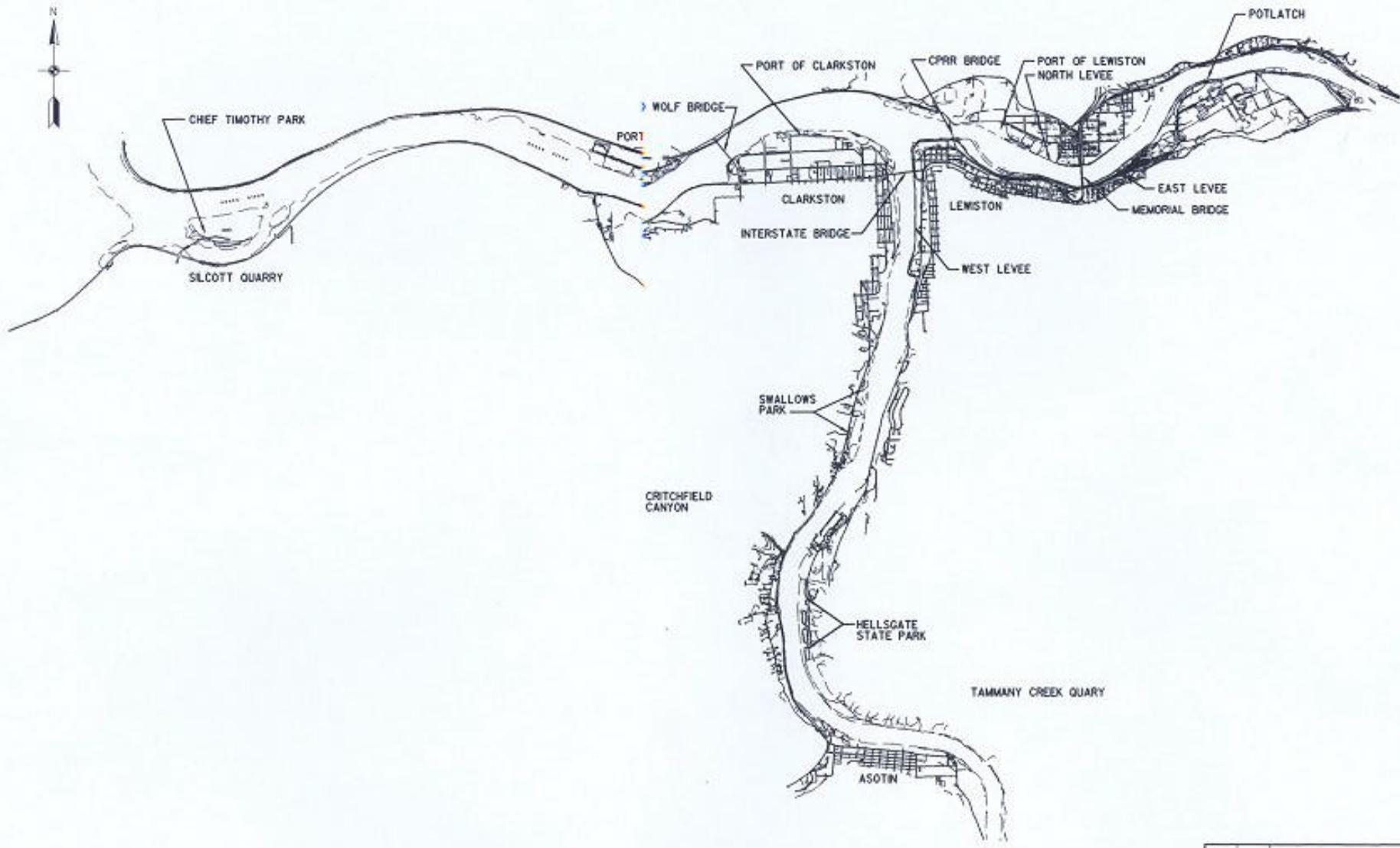
**Real estate administrative costs are for agreements with local governmental entities.

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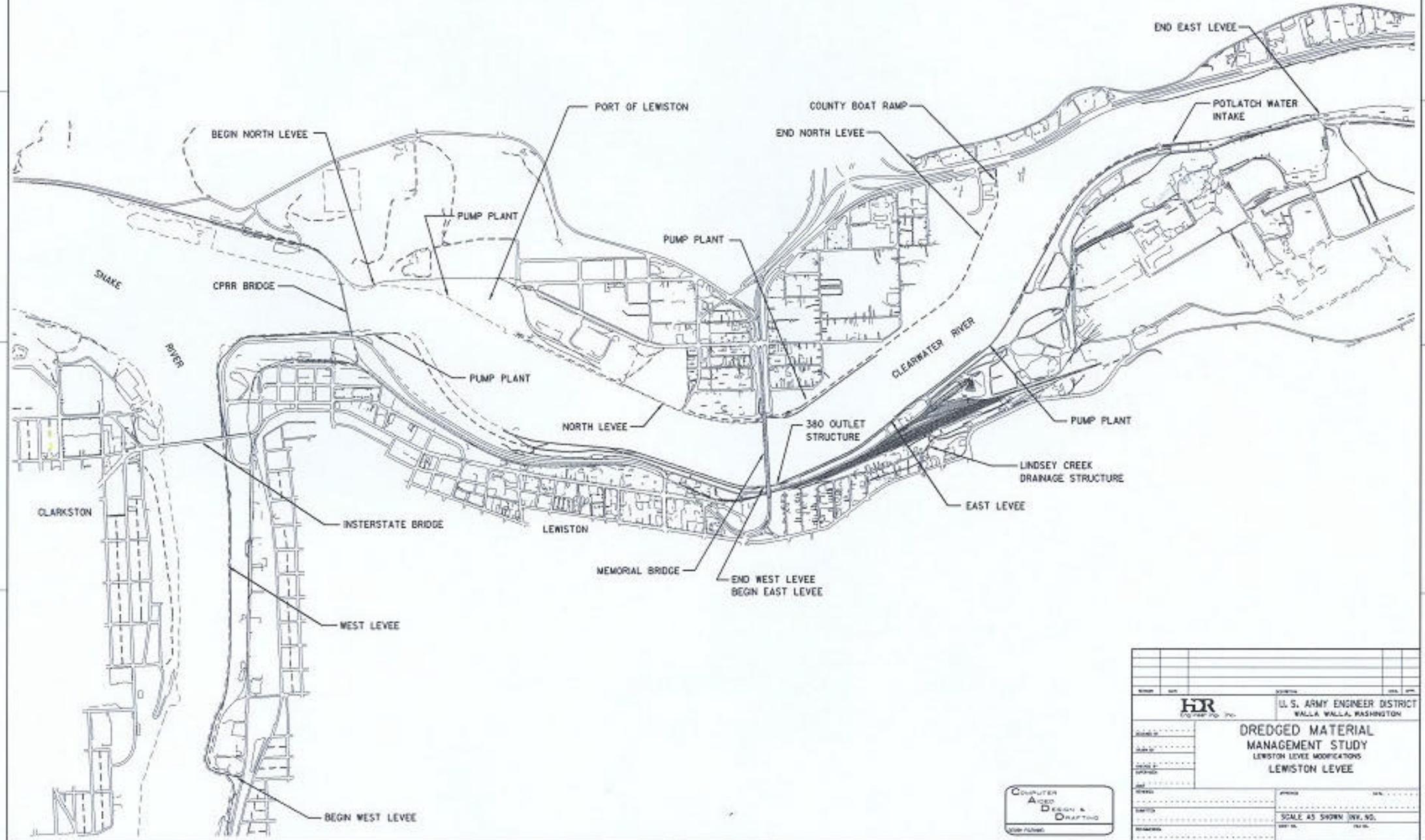
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U.S. Army Corps of Engineers. Engineer Circular 1110-2-554, Risk-Based Analysis in Geotechnical Engineering for Support of Planning Studies, 27 February 1998.

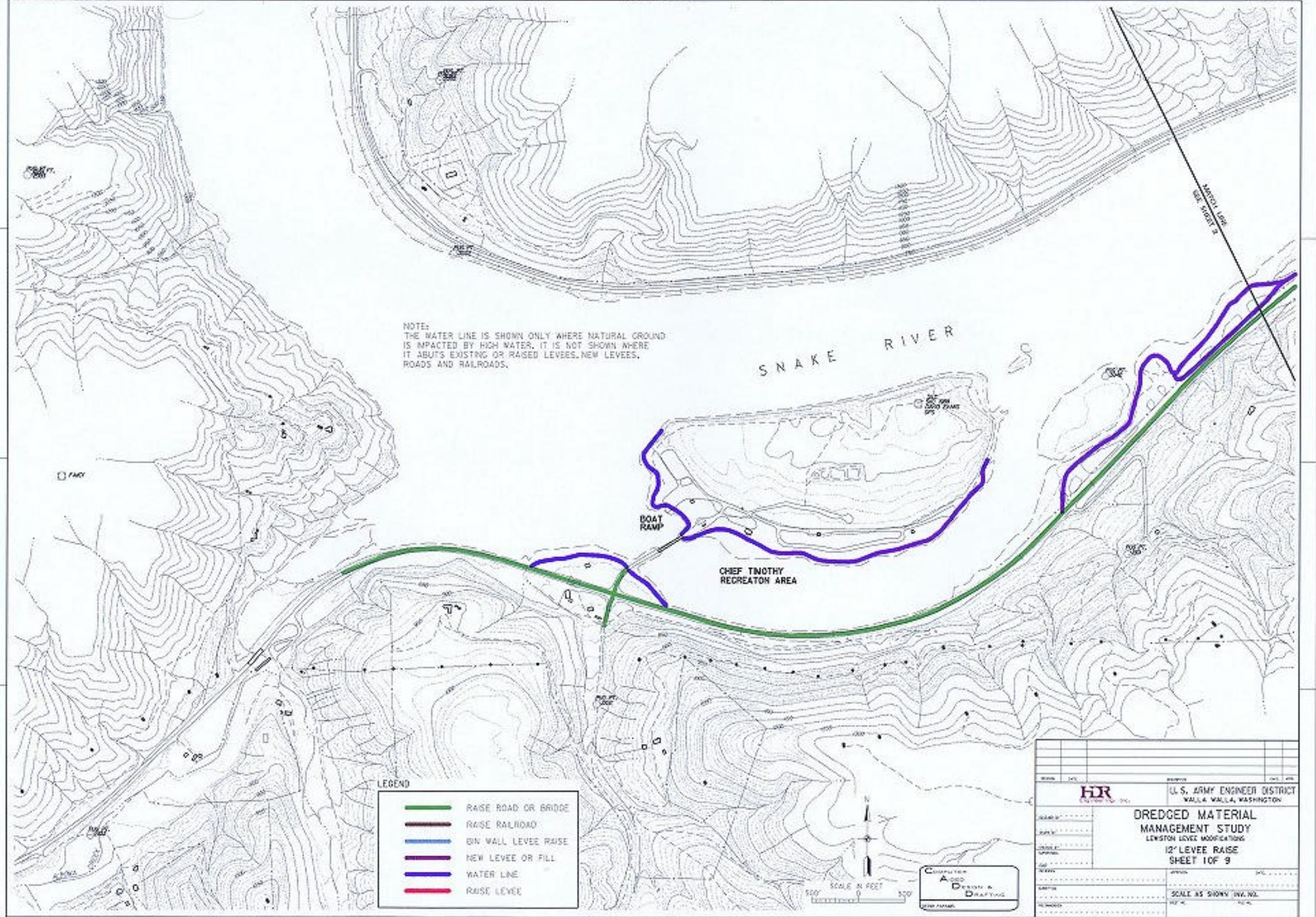


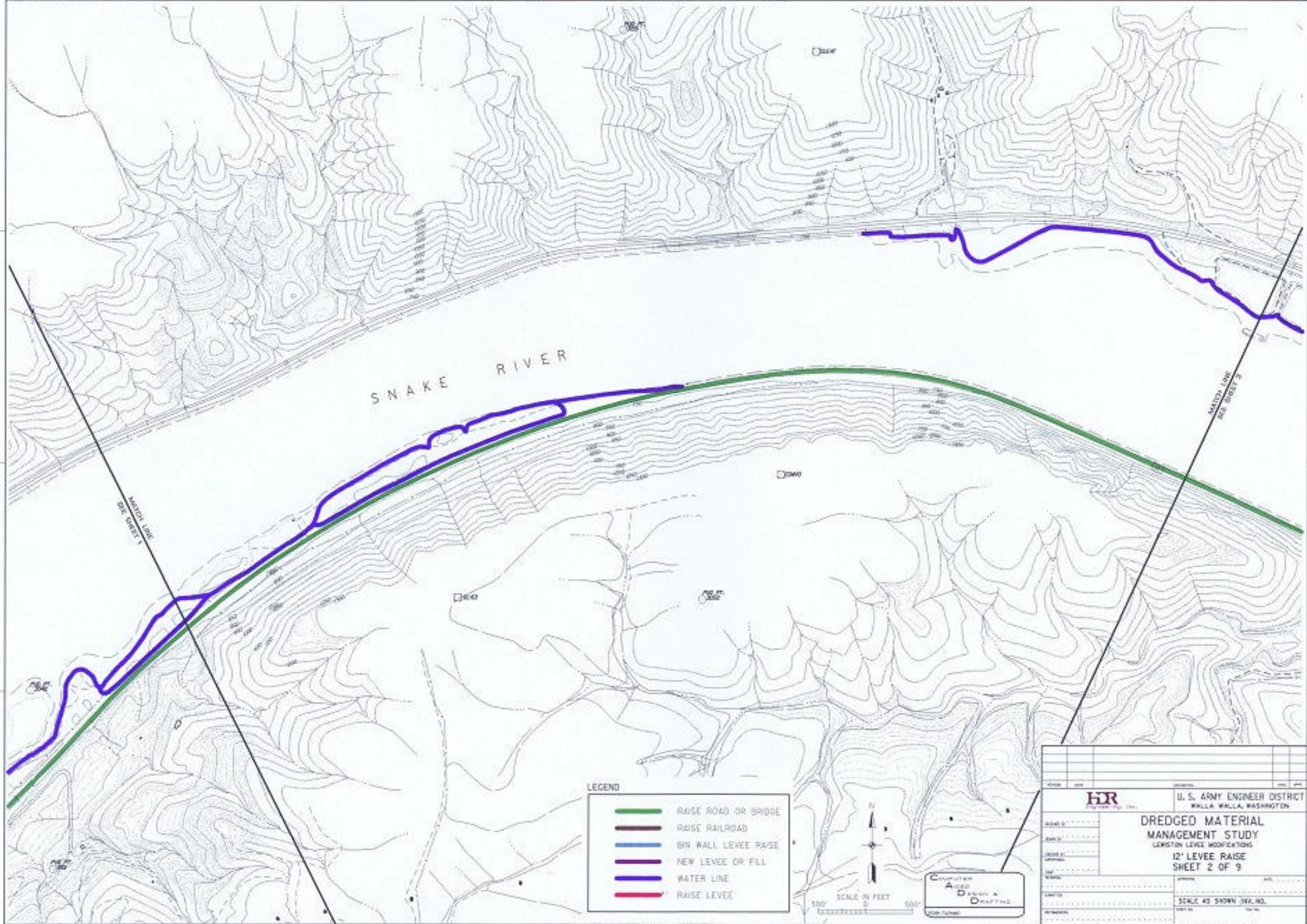
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DATE:		SCALE:	AS SHOWN (REV. NO. 1)
BY:		APP'D:	
CHECKED:		DATE:	
COMPUTER AIDED DESIGN & DRAFTING		CONT. NO. PLATE I	



		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY LEWISTON LEVEE MODIFICATIONS LEWISTON LEVEE			
PROJECT NO. DRAWING NO. DATE SCALE AS SHOWN (INV. NO.)	SHEET NO. TOTAL SHEETS	DESIGNED BY CHECKED BY DRAWN BY	DATE SCALE AS SHOWN (INV. NO.) SHEET NO. / TOTAL SHEETS

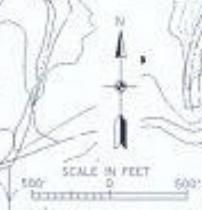
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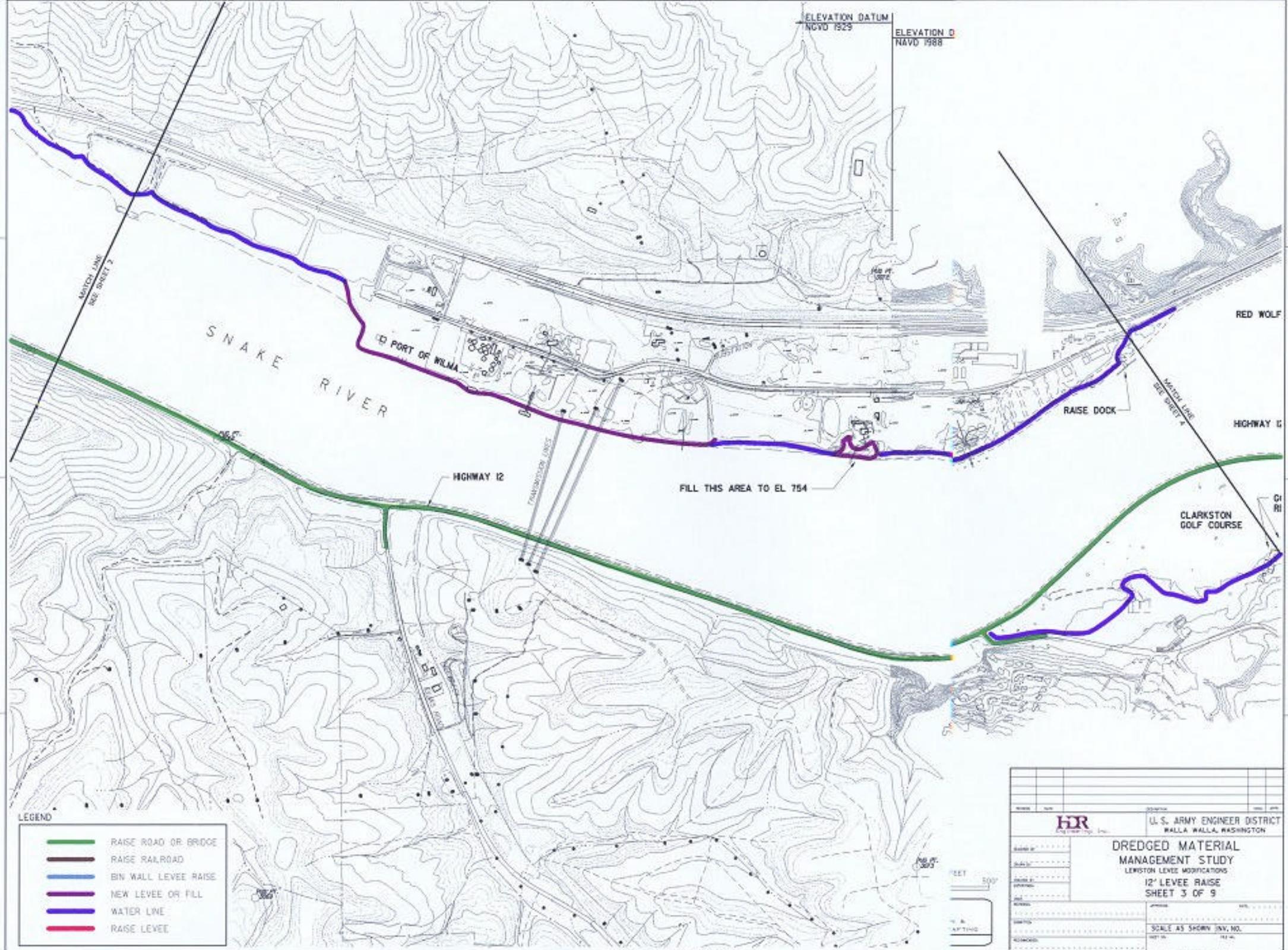
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	RAISE ROAD OR BRIDGE
	RAISE RAILROAD
	BIN WALL LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE



Computer
Aided
Design &
Drafting

		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY LEVEE LEVEL MODIFICATIONS 12' LEVEE RAISE SHEET 2 OF 9			
DATE:	SCALE:	SCALE AS SHOWN INV. NO.	
DRAWN BY:		CHECKED BY:	
DESIGNED BY:		APPROVED BY:	



- LEGEND
- RAISE ROAD OR BRIDGE
 - RAISE RAILROAD
 - BIN WALL LEVEE RAISE
 - NEW LEVEE OR FILL
 - WATER LINE
 - RAISE LEVEE

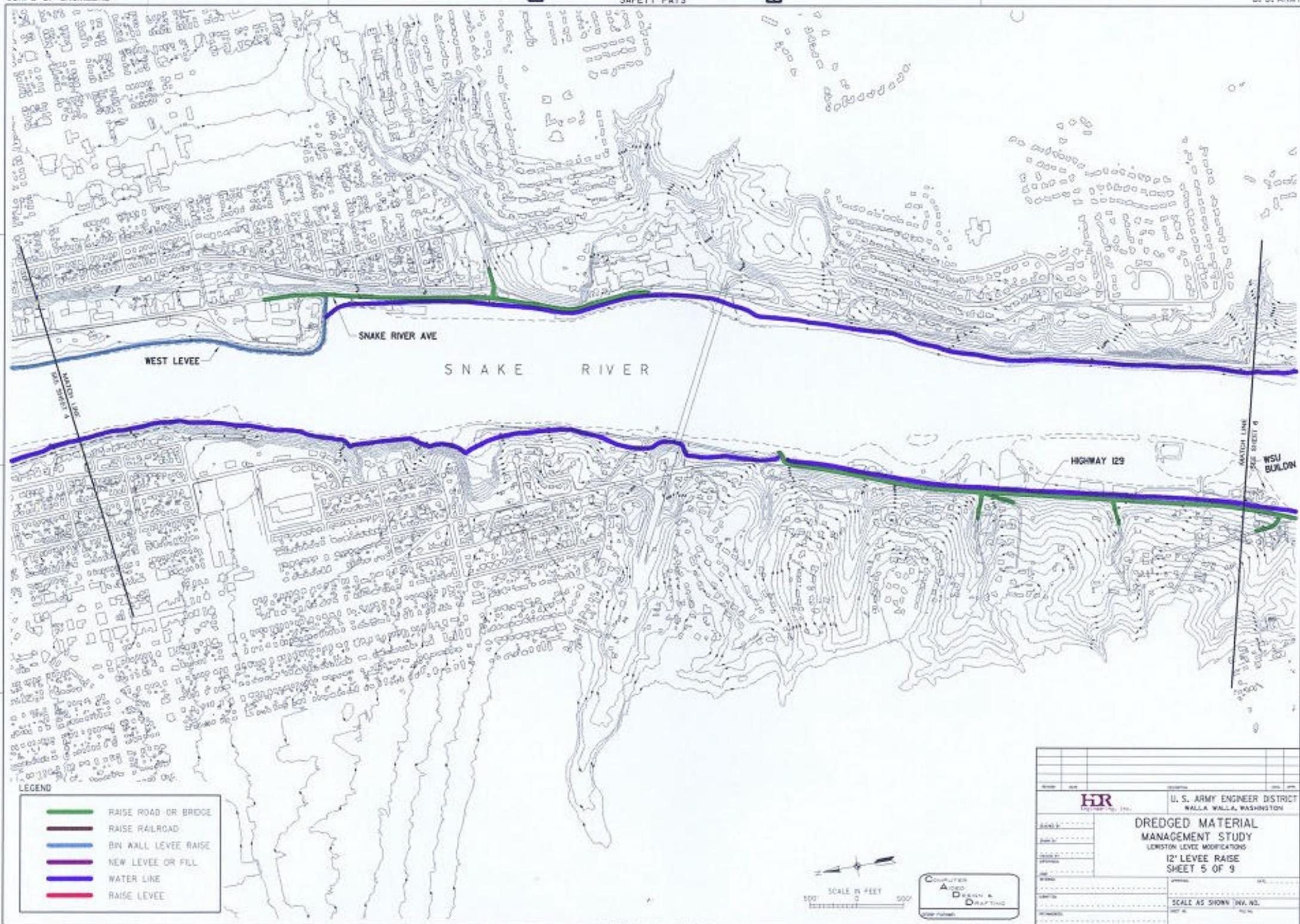
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DREDGED MATERIAL MANAGEMENT STUDY			
LEWISTON LEVEE MODIFICATIONS			
12" LEVEE RAISE			
SHEET 3 OF 9			
DATE:		SCALE AS SHOWN INV. NO.	
DRAWN BY:		DATE:	
CHECKED BY:		DATE:	
APPROVED BY:		DATE:	



LEGEND

	RAISE ROAD OR BRIDGE
	RAISE RAILROAD
	BN WALL LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE

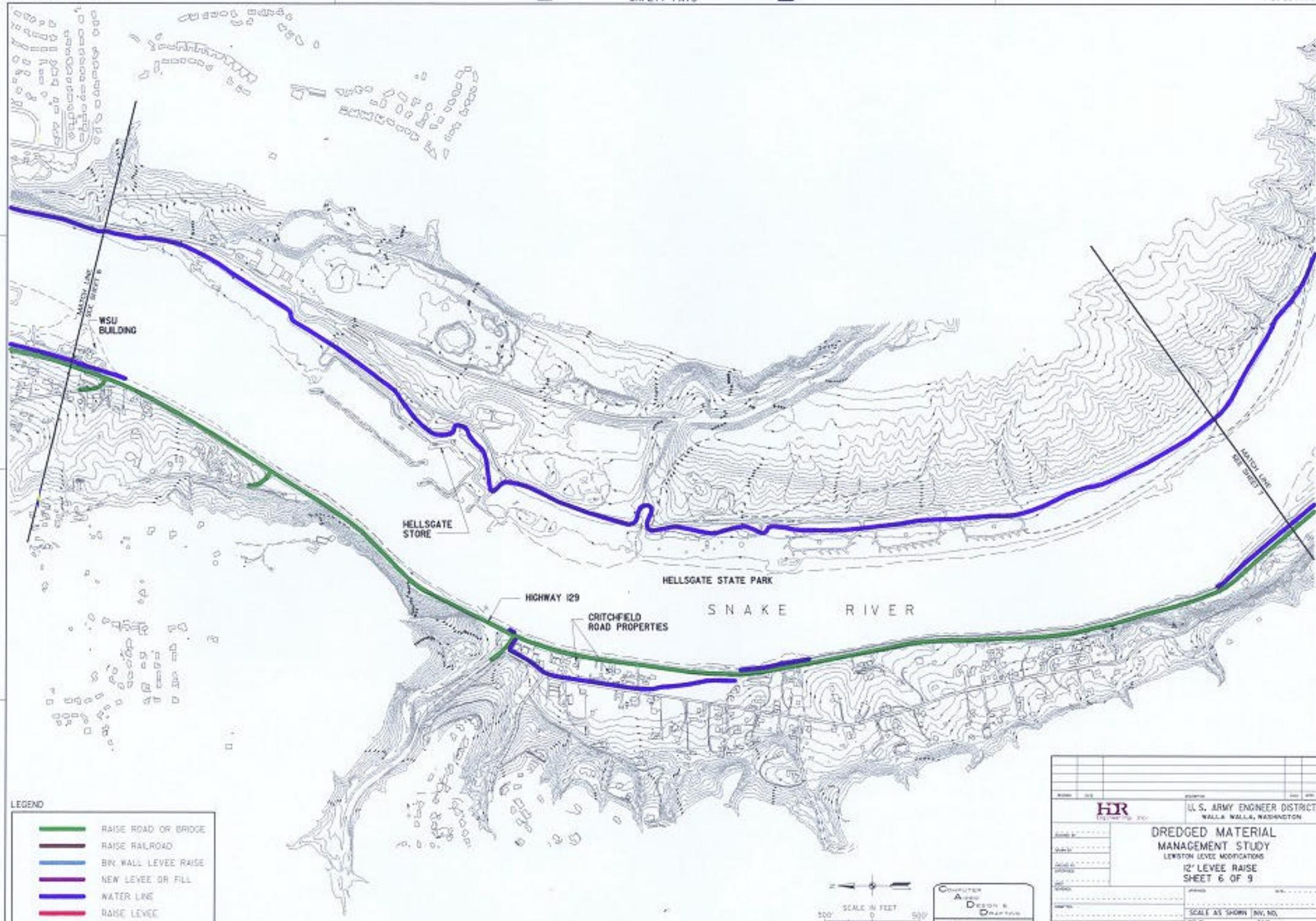
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DREDGED MATERIAL MANAGEMENT STUDY			
LENSTON LEVEE MODIFICATIONS			
12' LEVEE RAISE			
SHEET 4 OF 9			
SCALE AS SHOWN (INV. NO. _____)		DATE _____	



LEGEND

	RAISE ROAD OR BRIDGE
	RAISE RAILROAD
	BN WALL LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE

		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEVEE LEVEL MODIFICATIONS			
12' LEVEE RAISE			
SHEET 5 OF 9			
SCALE AS SHOWN (INV. NO.)		DATE	



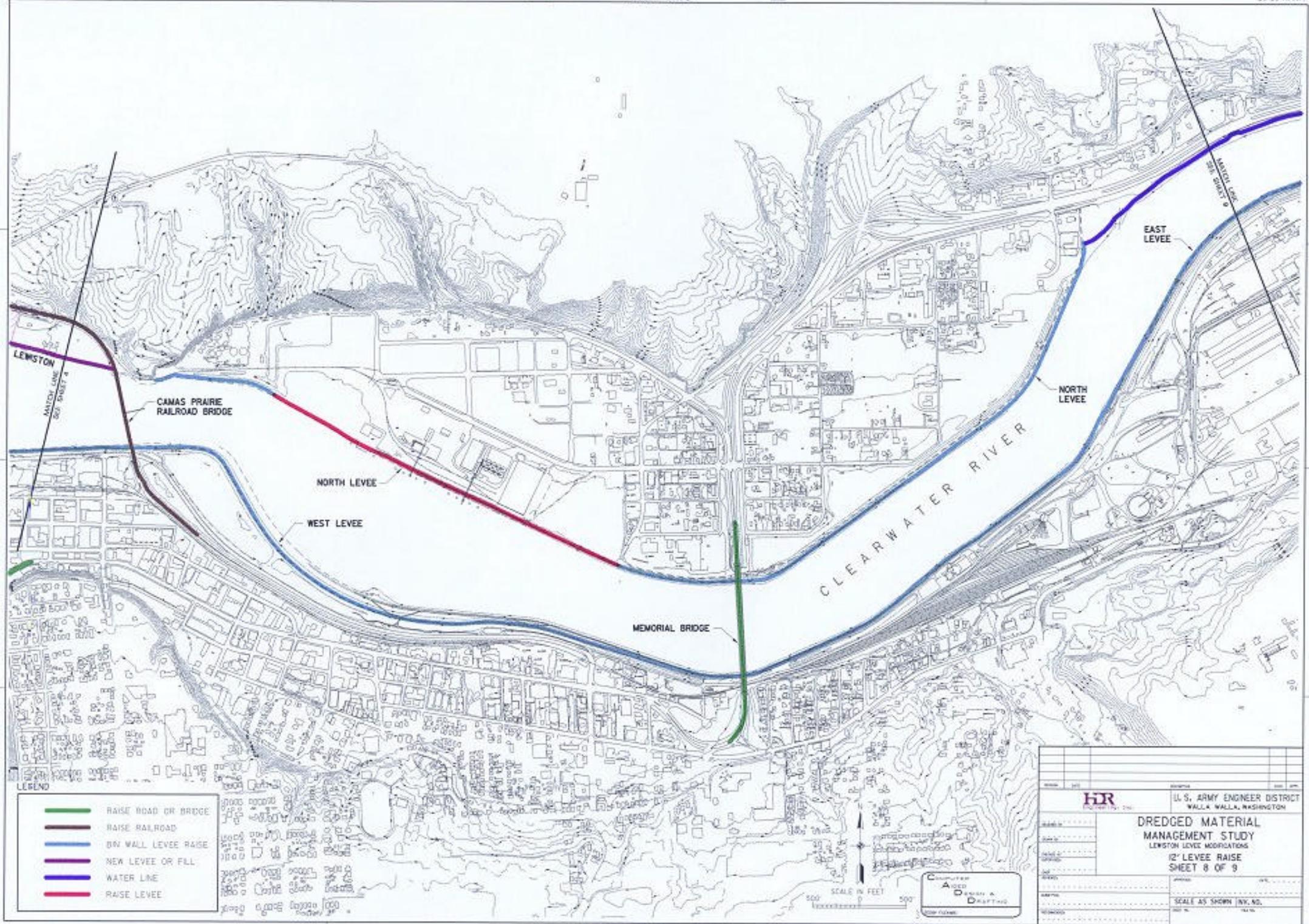
LEGEND

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	RAISE RAILROAD
	BIN, WALL, LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE



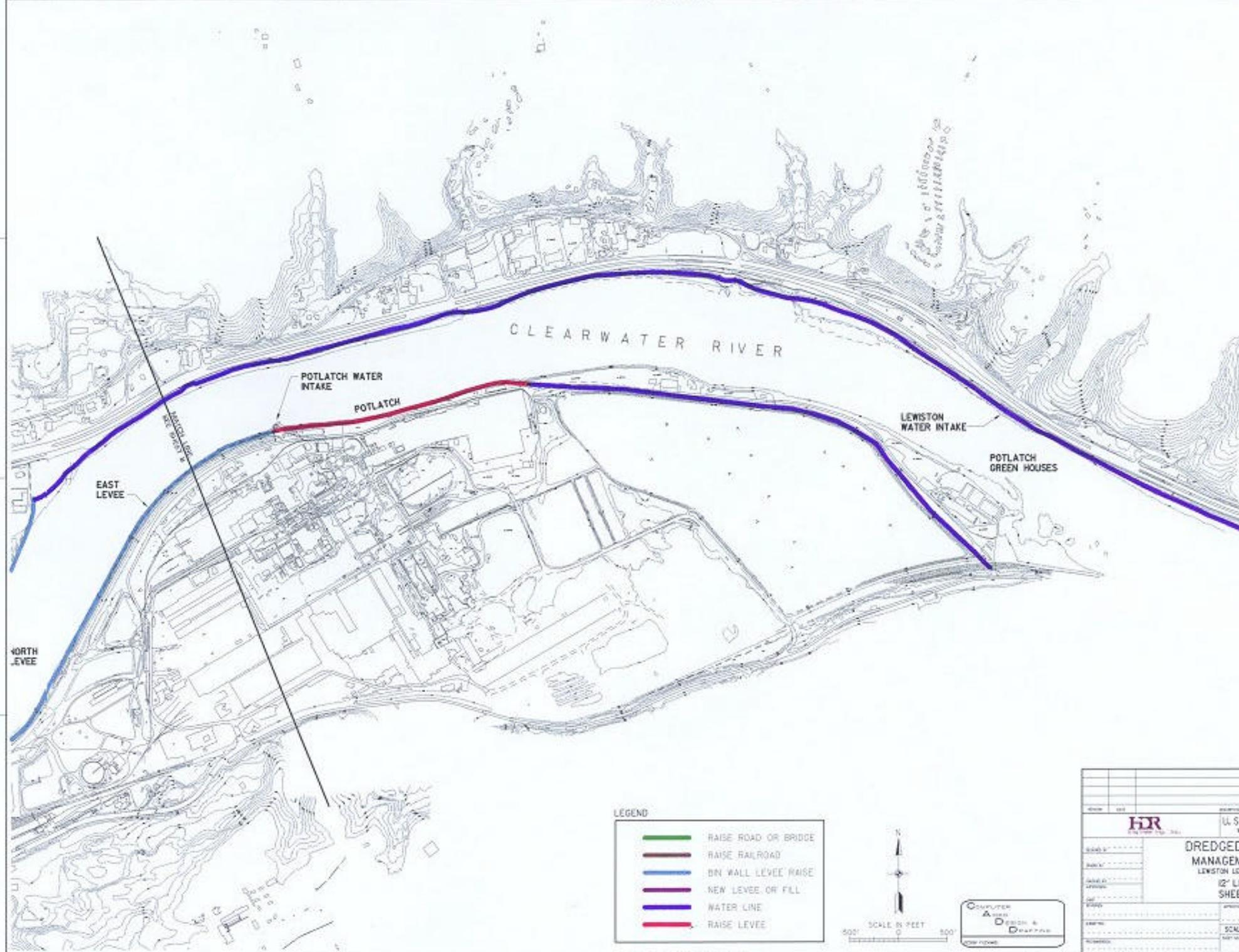
COMPUTER
Aided
DESIGN &
DRAFTING

		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEWISTON LEVEE MODIFICATIONS			
12" LEVEE RAISE			
SHEET 6 OF 9			
SCALE AS SHOWN (BY NO.)		12" = 1"	



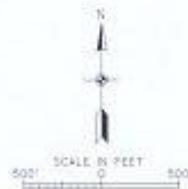
- LEGEND
- RAISE ROAD OR BRIDGE
 - RAISE RAILROAD
 - DRY WALL LEVEE RAISE
 - NEW LEVEE OR FILL
 - WATER LINE
 - RAISE LEVEE

HR		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEWISTON LEVEE MODIFICATIONS			
12' LEVEE RAISE			
SHEET 8 OF 9			
DATE: _____		SCALE AS SHOWN (IN. NO. _____)	
DRAWN BY: _____		DATE: _____	
CHECKED BY: _____		DATE: _____	
APPROVED BY: _____		DATE: _____	



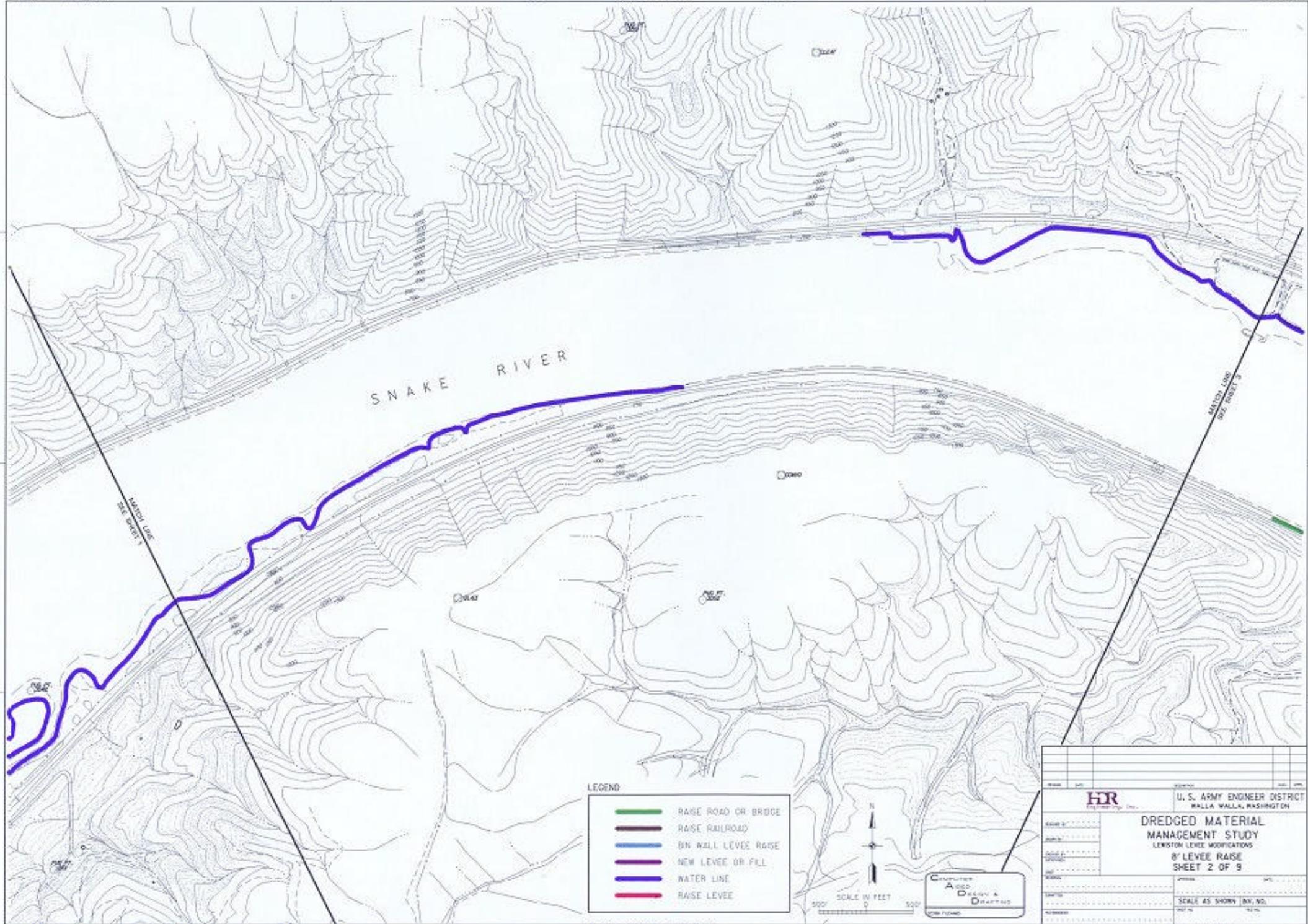
LEGEND

- RAISE ROAD OR BRIDGE
- RAISE RAILROAD
- DN WALL LEVEE RAISE
- NEW LEVEE OR FILL
- WATER LINE
- RAISE LEVEE



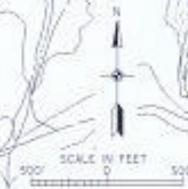
COMPUTER
DESIGN &
DRAWING

HR		U. S. ARMY ENGINEER DISTRICT WALL & WALL, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEWISTON LEVEE MODIFICATIONS			
12" LEVEE RAISE			
SHEET 9 OF 9			
SCALE AS SHOWN (INCHES)		DATE	
DATE		DATE	



LEGEND

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	RAISE RAILROAD
	BN WALL LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE

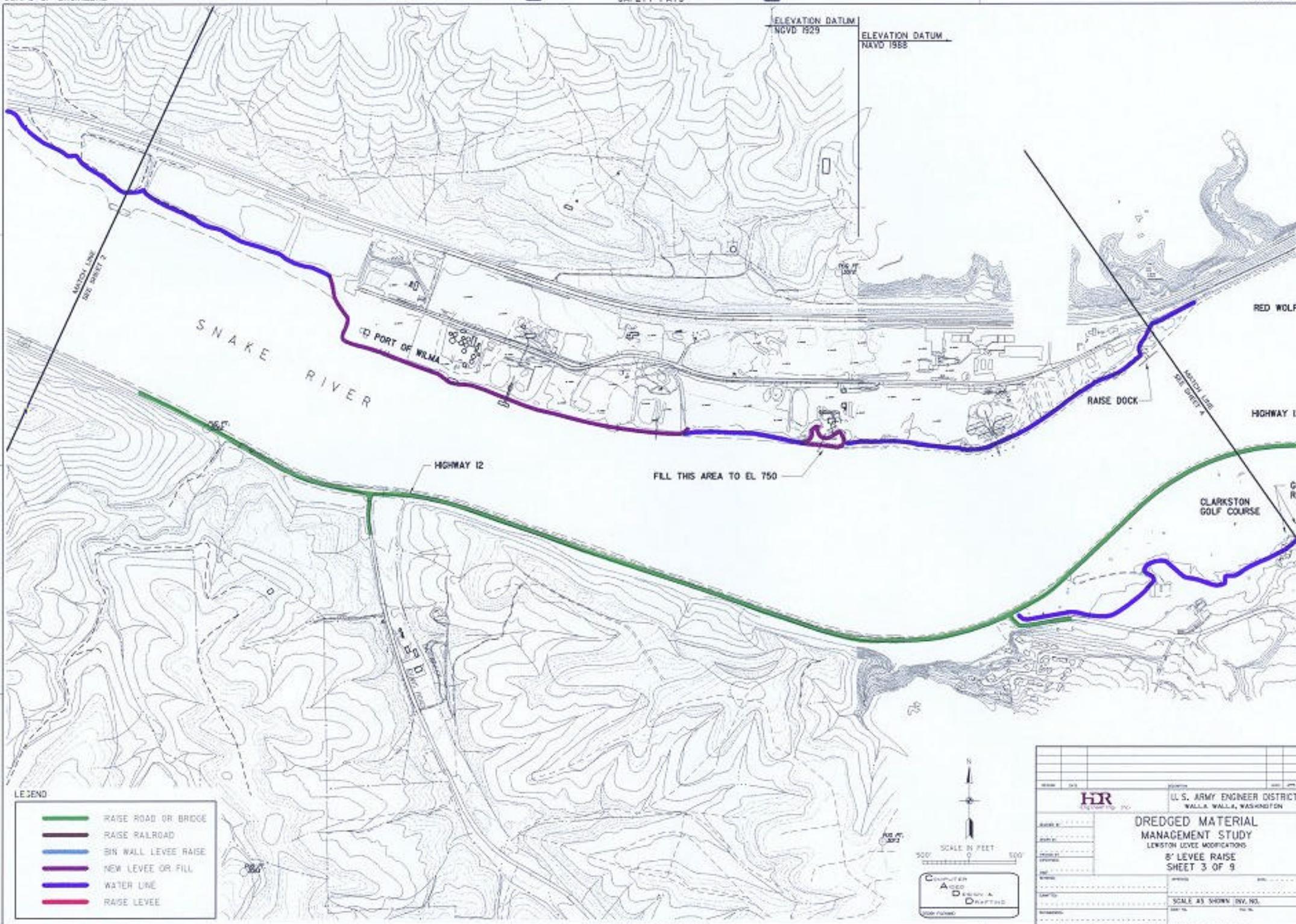


Computer Aided Design & Drafting

		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEVEE LEVEL MODIFICATIONS			
8' LEVEE RAISE			
SHEET 2 OF 9			
SCALE AS SHOWN (BY NO.)			

ELEVATION DATUM
NCVD 1929

ELEVATION DATUM
NAVD 1988



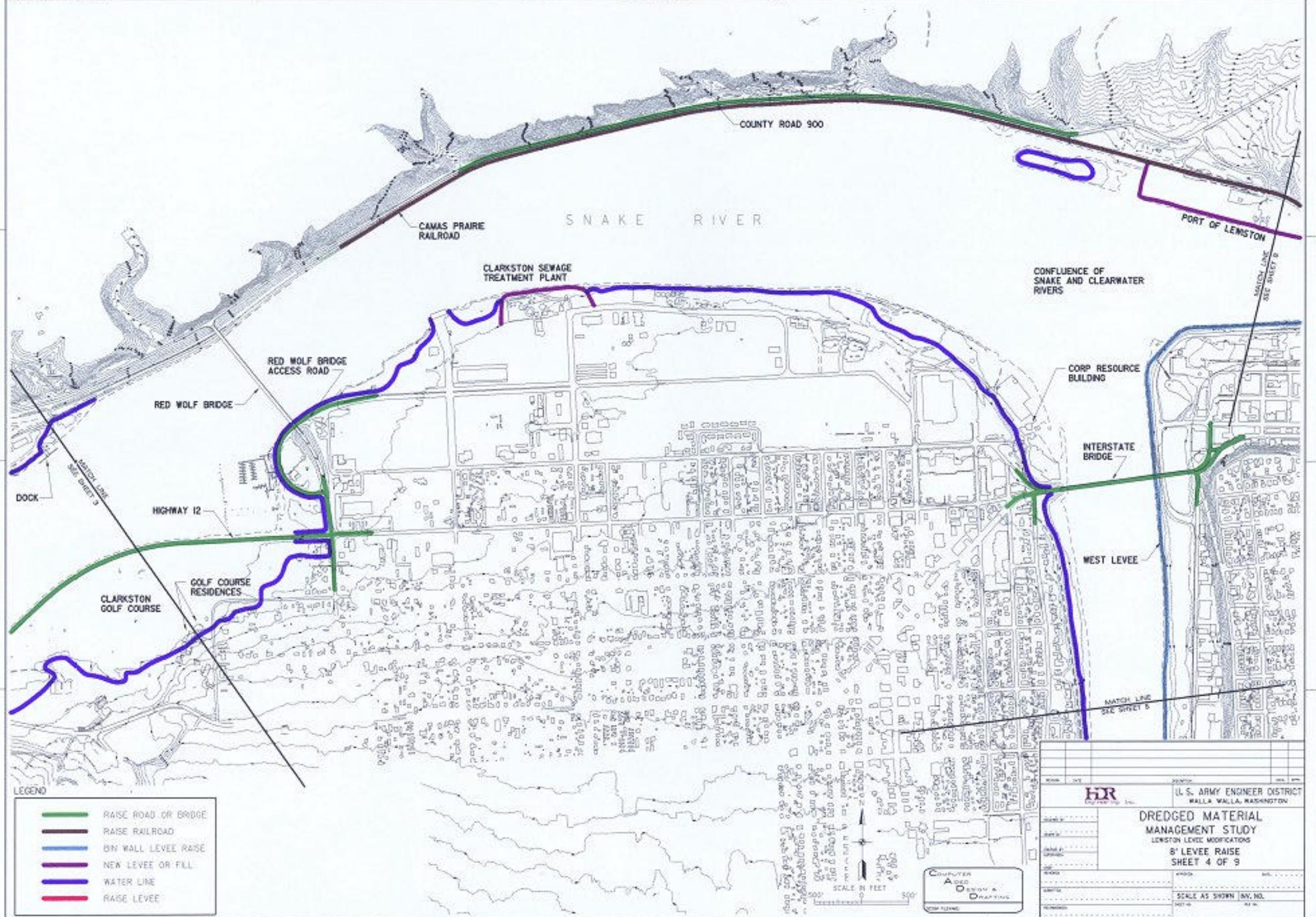
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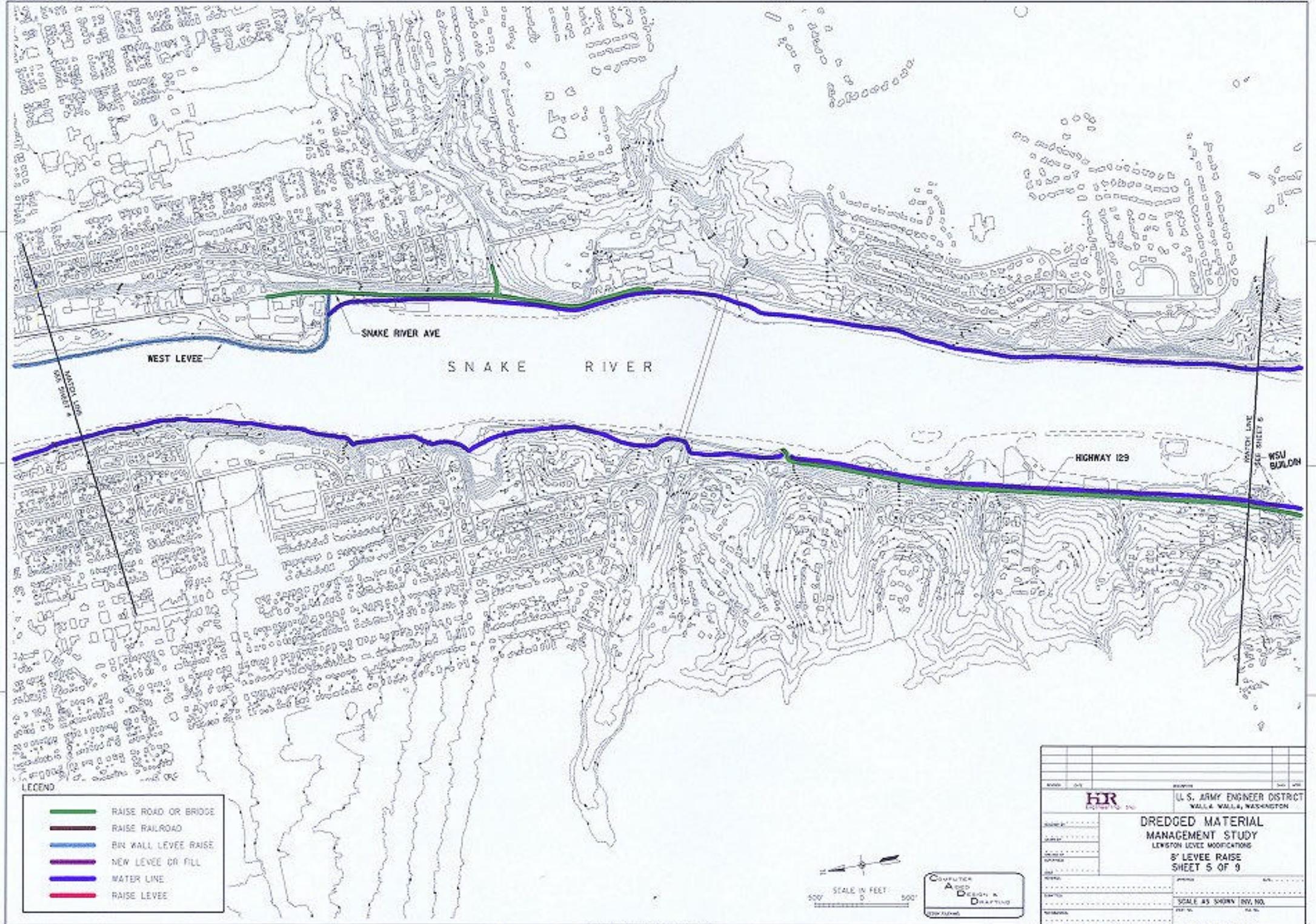
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	RAISE RAILROAD
	BR WALL LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE

SCALE IN FEET
0 500 1000

COMPUTER
Aided
DESIGN &
DRAFTING

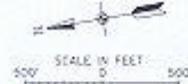
		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEWISTON LEVEE MODIFICATIONS			
8' LEVEE RAISE			
SHEET 3 OF 9			
SCALE AS SHOWN INV. NO.			





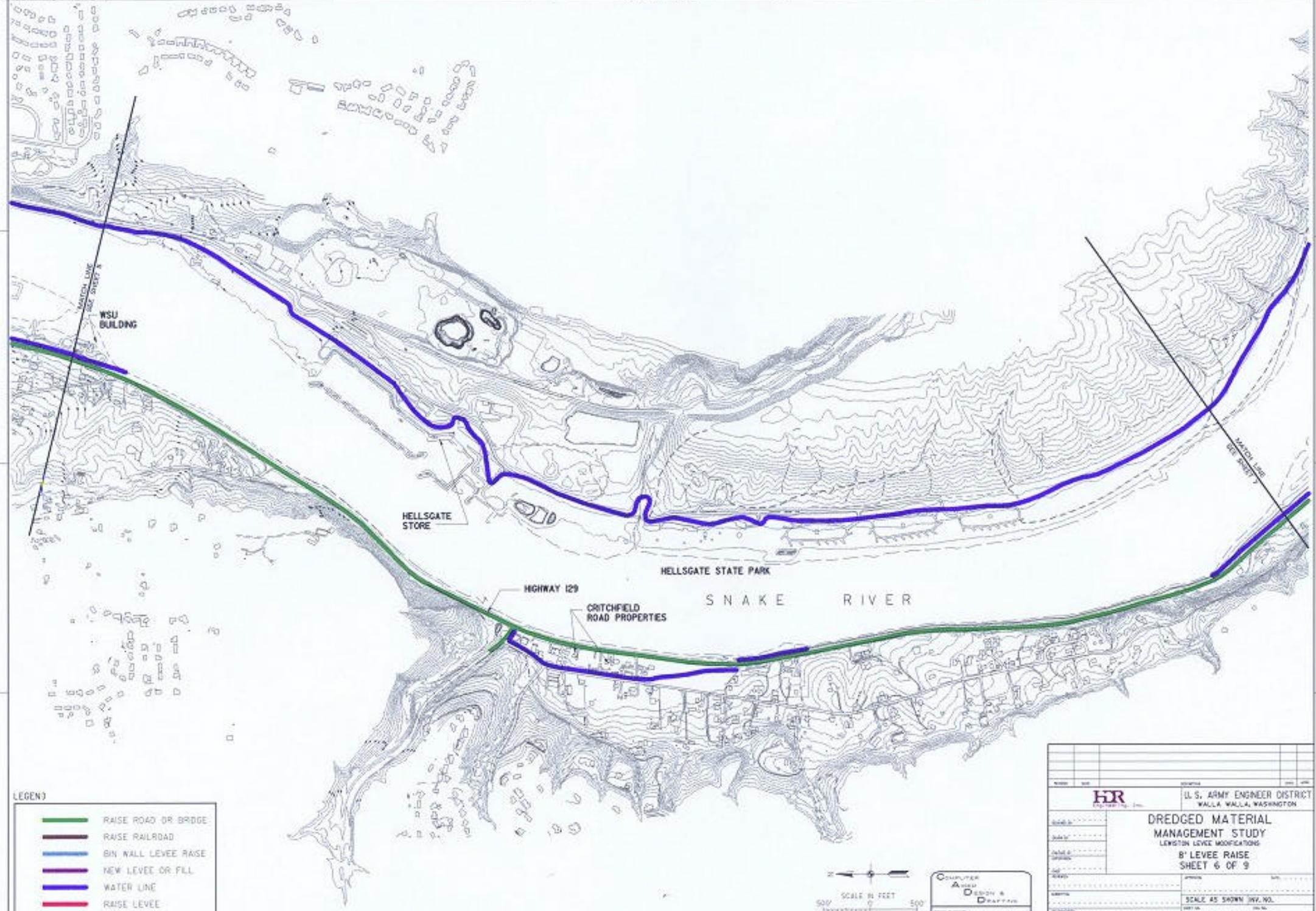
LEGEND

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	RAISE RAILROAD
	BR WALL LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE



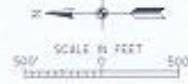
COMPUTER
Aided
DESIGN &
DRAFTING

		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEWISTON LEVEL MODIFICATIONS			
8' LEVEE RAISE			
SHEET 5 OF 9			
DATE:	PROJECT:	SCALE AS SHOWN (REV. NO.)	FILE NO.
DRAWN BY:	CHECKED BY:		
DESIGNED BY:	APPROVED BY:		
DATE:	DATE:		



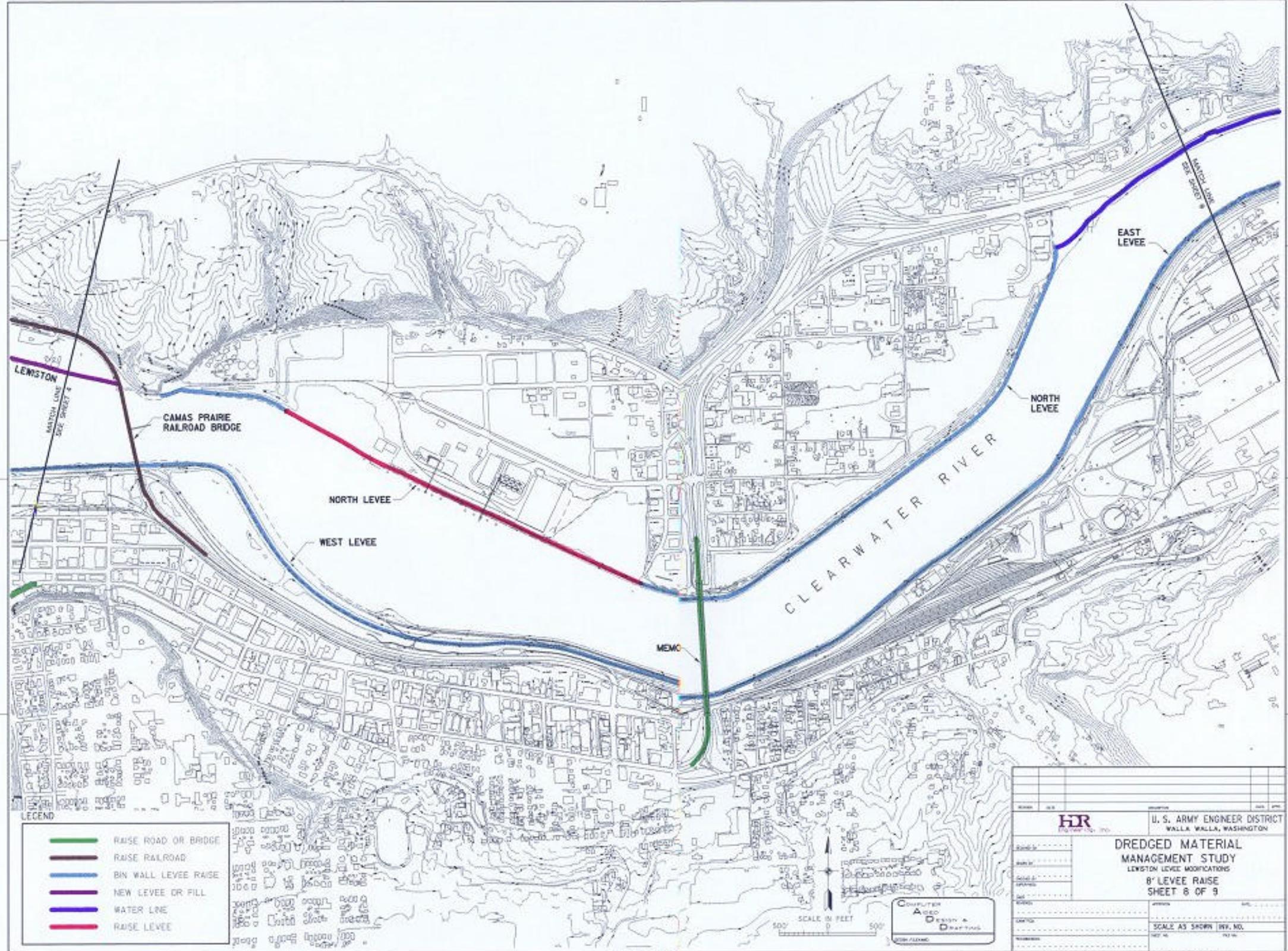
LEGEND

- RAISE ROAD OR BRIDGE
- RAISE RAILROAD
- BIN WALL LEVEE RAISE
- NEW LEVEE OR FILL
- WATER LINE
- RAISE LEVEE



COMPUTER
Aided
DESIGN &
DRAFTING

HR Engineering, Inc.		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY LEWISTON LEVEE MODIFICATIONS B' LEVEE RAISE SHEET 6 OF 9			
DATE:	BY:	SCALE:	NO.:
SCALE AS SHOWN INV. NO.			



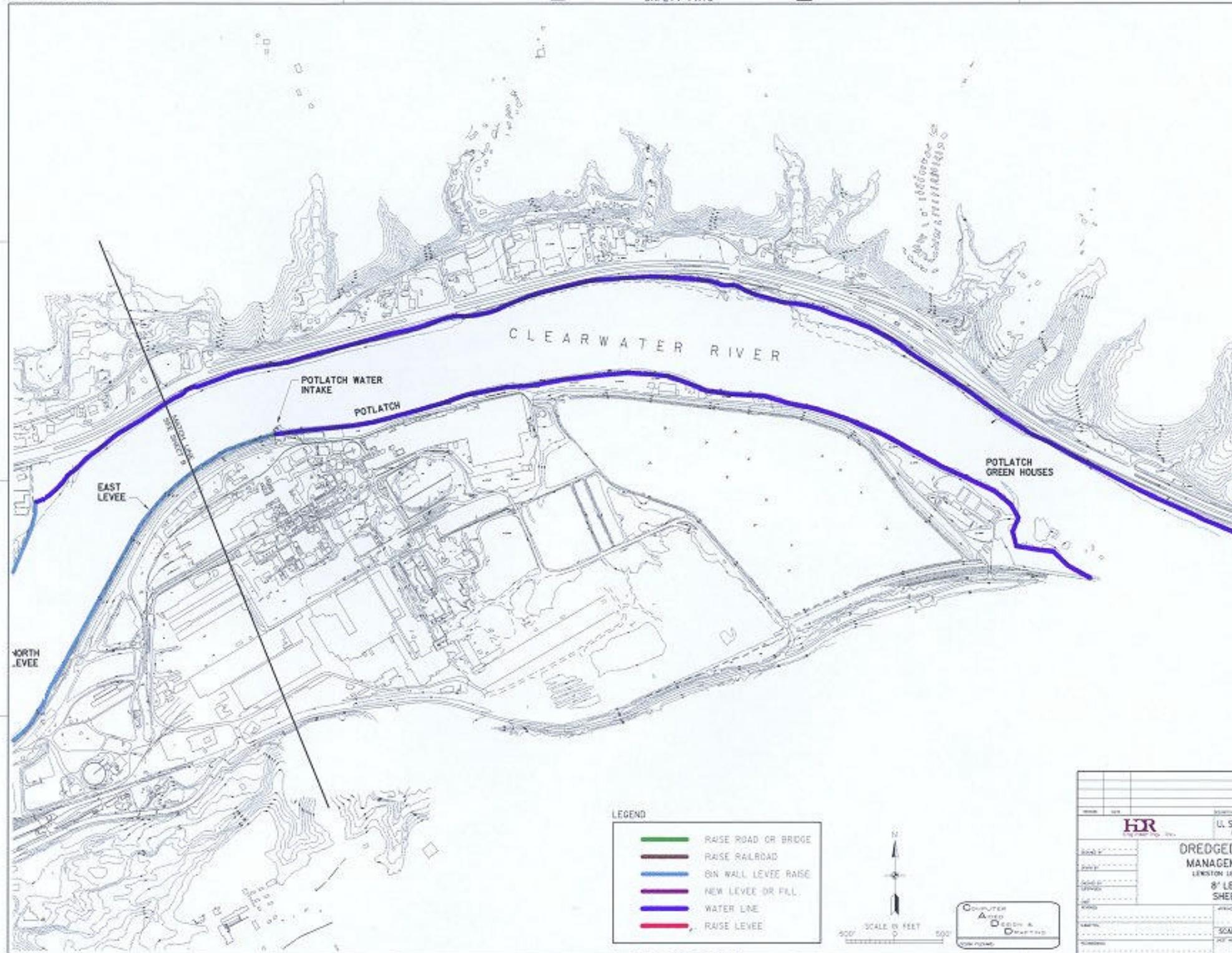
LEGEND

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	RAISE RAILROAD
	BIN WALL LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE



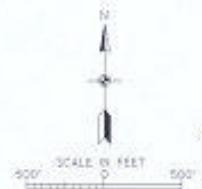
Computer
Aided
Design &
Drafting
BY: JLM/MLC

		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEWISTON LEVEE MODIFICATIONS			
8' LEVEE RAISE			
SHEET 8 OF 9			
DATE:	BY:	APP'D:	CHK'D:
SCALE AS SHOWN (REF. NO. 102-14)			

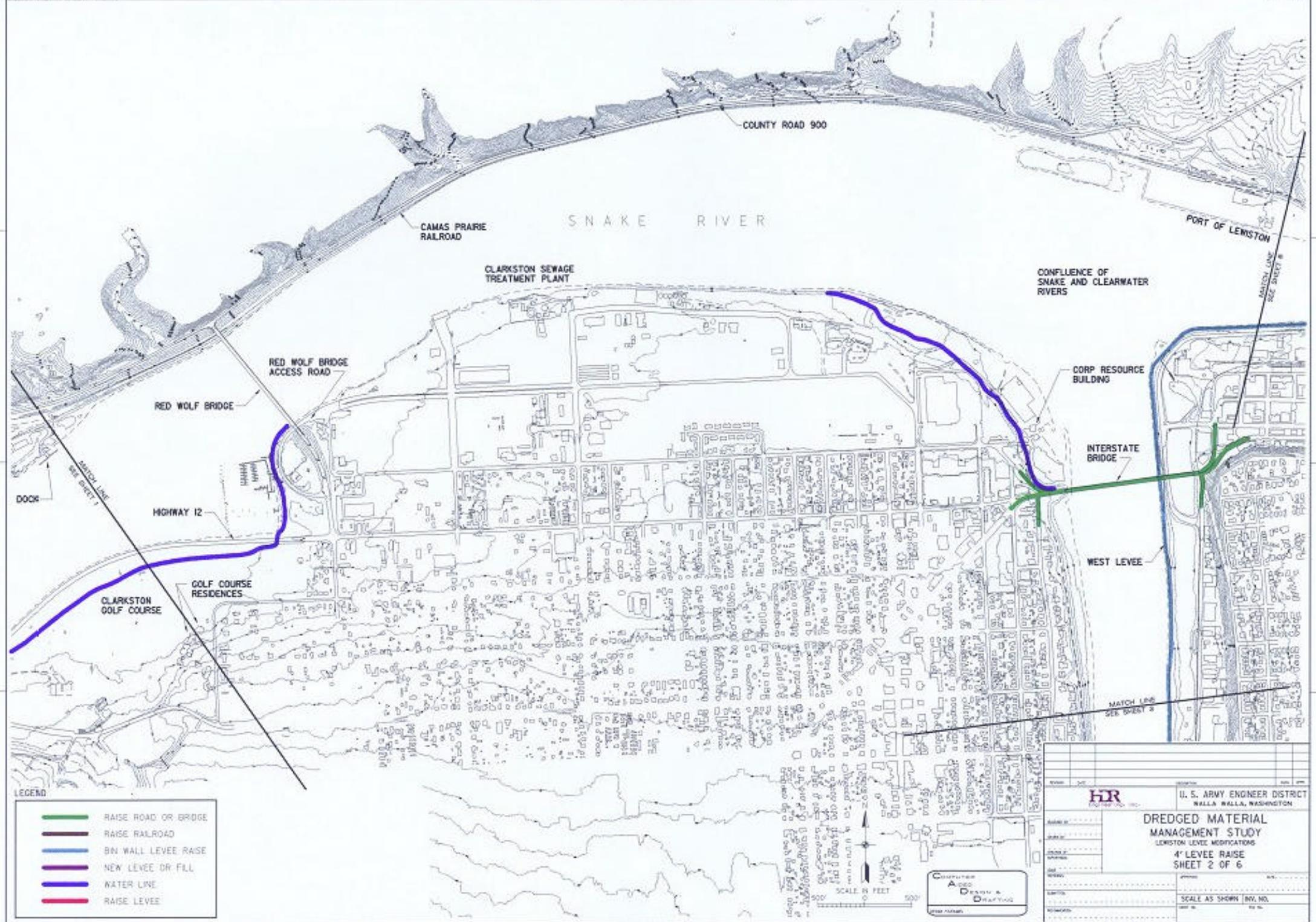


LEGEND

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	RAISE RAILROAD
	BN WALL LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE



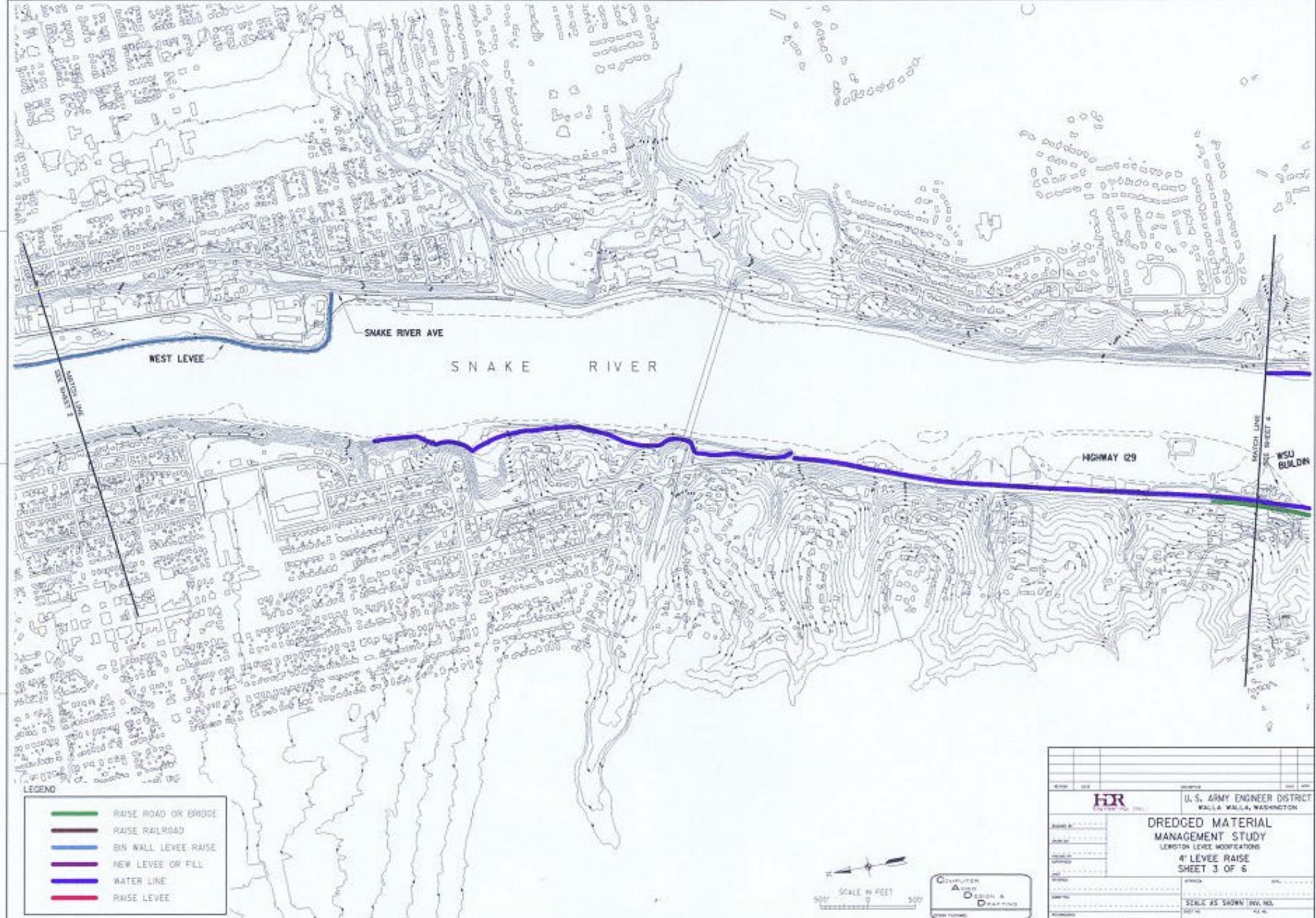
HR		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEVEE LEVEL MODIFICATIONS			
8' LEVEE RAISE			
SHEET 9 OF 9			
SCALE AS SHOWN (REV. NO. 1)		DATE	



U. S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON

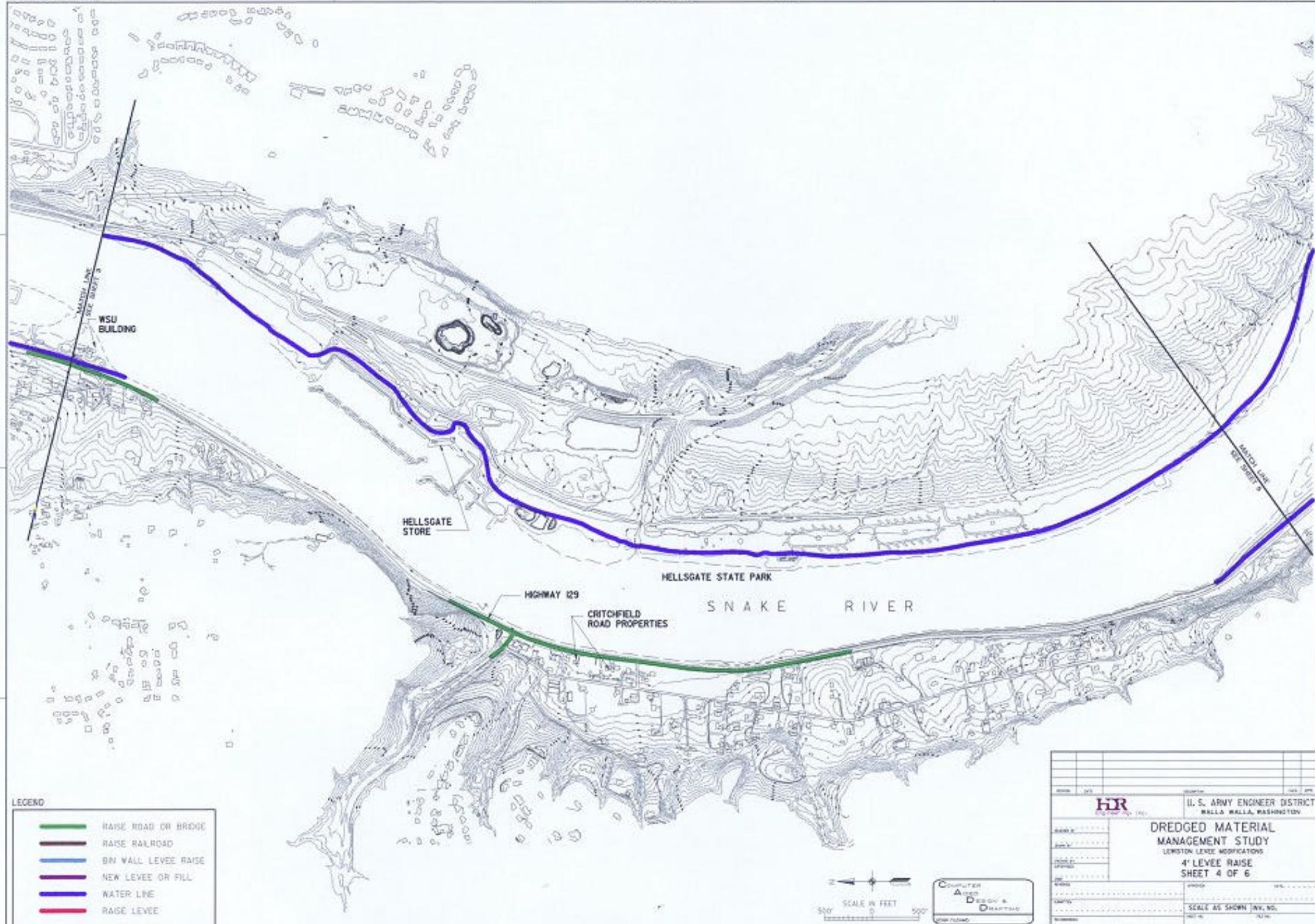
**DREDGED MATERIAL
MANAGEMENT STUDY**
LEMSTON LEVEE MODIFICATIONS
4' LEVEE RAISE
SHEET 2 OF 6

SCALE AS SHOWN INV. NO.



- LEGEND
- RAISE ROAD OR BRIDGE
 - RAISE RAILROAD
 - BIN WALL LEVEE RAISE
 - NEW LEVEE OR FILL
 - WATER LINE
 - RAISE LEVEE

HR		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEWISTON LEVEE MODIFICATIONS			
4' LEVEE RAISE			
SHEET 3 OF 6			
DATE:	BY:	APP'D:	CHK'D:
SCALE:	SCALE:	SCALE:	SCALE:
SCALE AS SHOWN TRV. NO.		SCALE:	



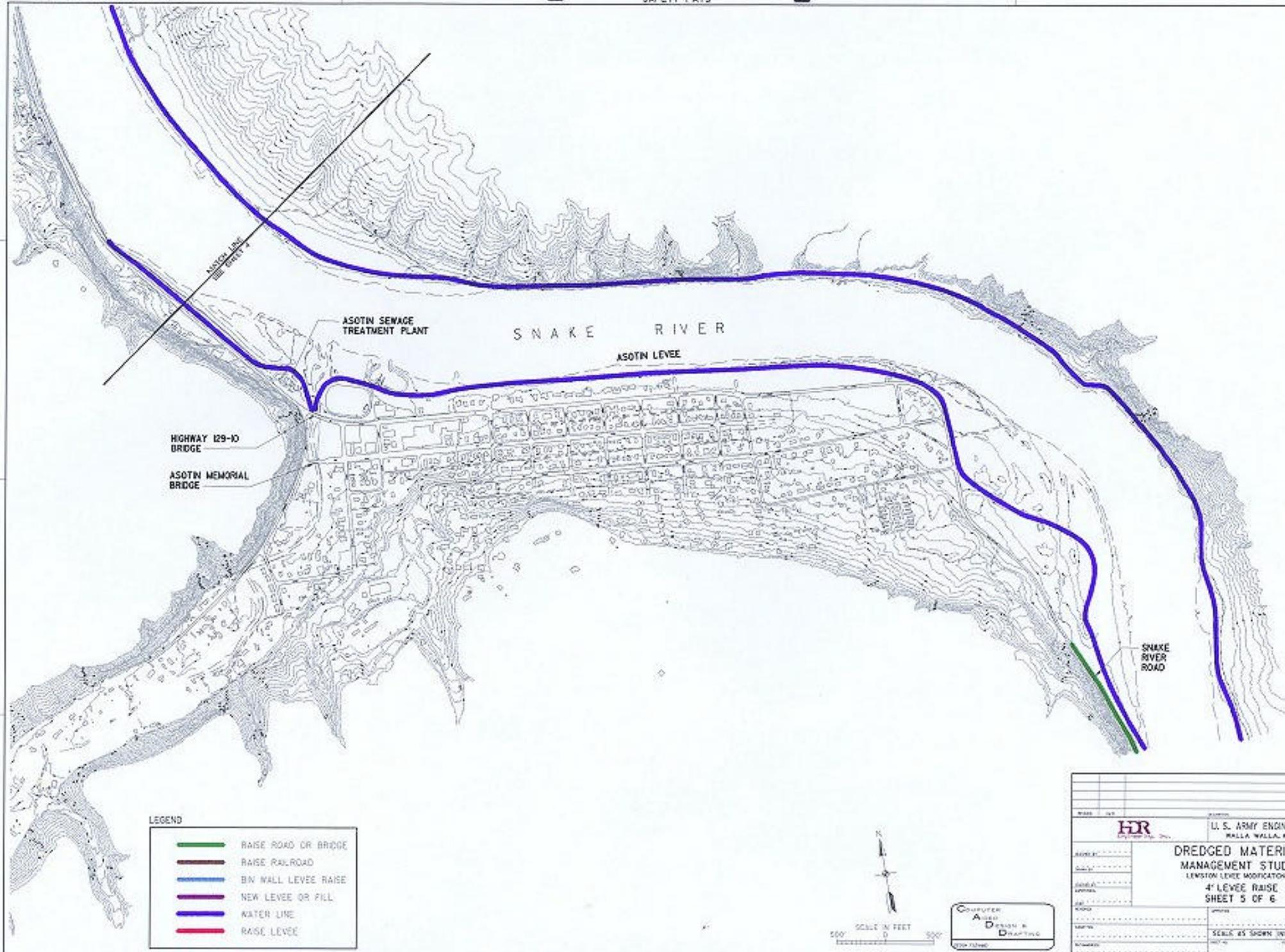
LEGEND

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	RAISE RAILROAD
	BN WALL LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE



COMPUTER
Aided
DESIGN &
DRAWING

		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEVEE LENS MODIFICATIONS			
4' LEVEE RAISE			
SHEET 4 OF 6			
DATE:		SCALE AS SHOWN (N, V)	
DRAWN BY:		DATE:	
CHECKED BY:		SCALE:	
APPROVED BY:		DATE:	



LEGEND

	RAISE ROAD OR BRIDGE
	RAISE RAILROAD
	BN WALL LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE

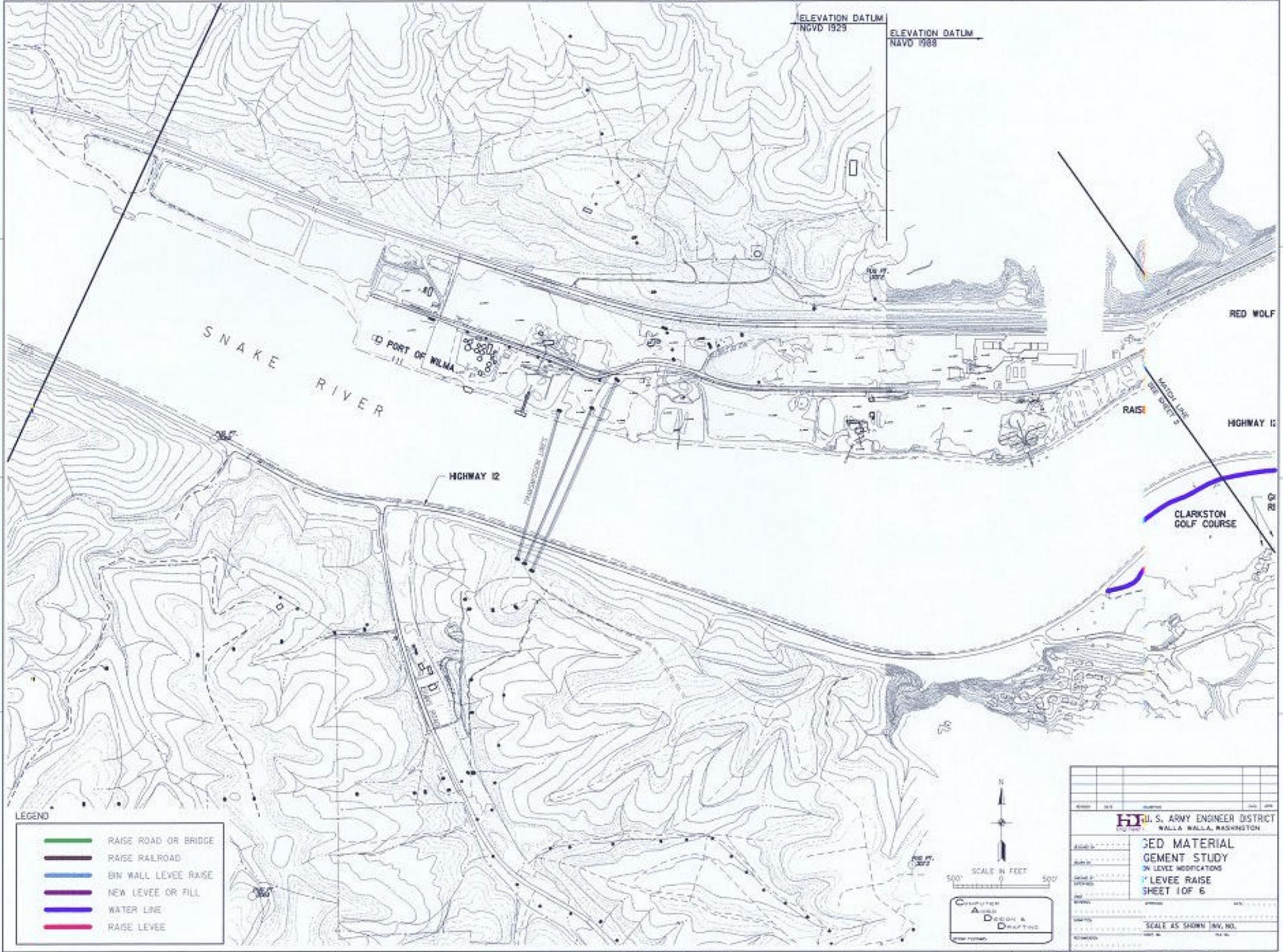


COMPUTER
Aided
DESIGN &
DRAWING

		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON
DREDGED MATERIAL MANAGEMENT STUDY LEWISTON LEVEE MODIFICATIONS 4' LEVEE RAISE SHEET 5 OF 6		
PROJECT NO. DATE DRAWN BY CHECKED BY SCALE AS SHOWN (IN. NO.)	SHEET NO. TOTAL SHEETS	DATE SCALE AS SHOWN (IN. NO.)

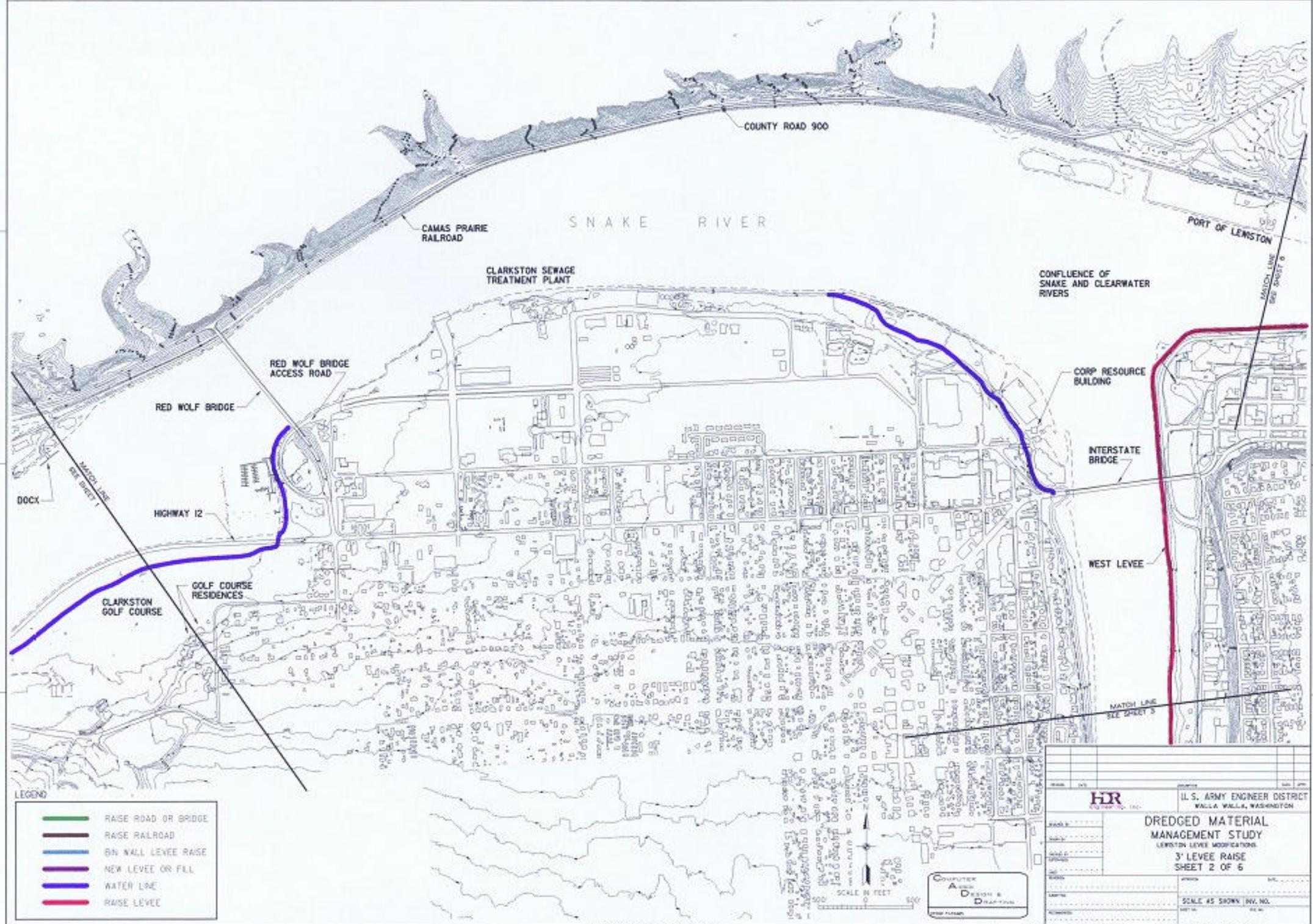
ELEVATION DATUM
NGVD 1929

ELEVATION DATUM
NAVD 1988



- LEGEND
- RAISE ROAD OR BRIDGE
 - RAISE RAILROAD
 - BIN WALL LEVEE RAISE
 - NEW LEVEE OR FILL
 - WATER LINE
 - RAISE LEVEE

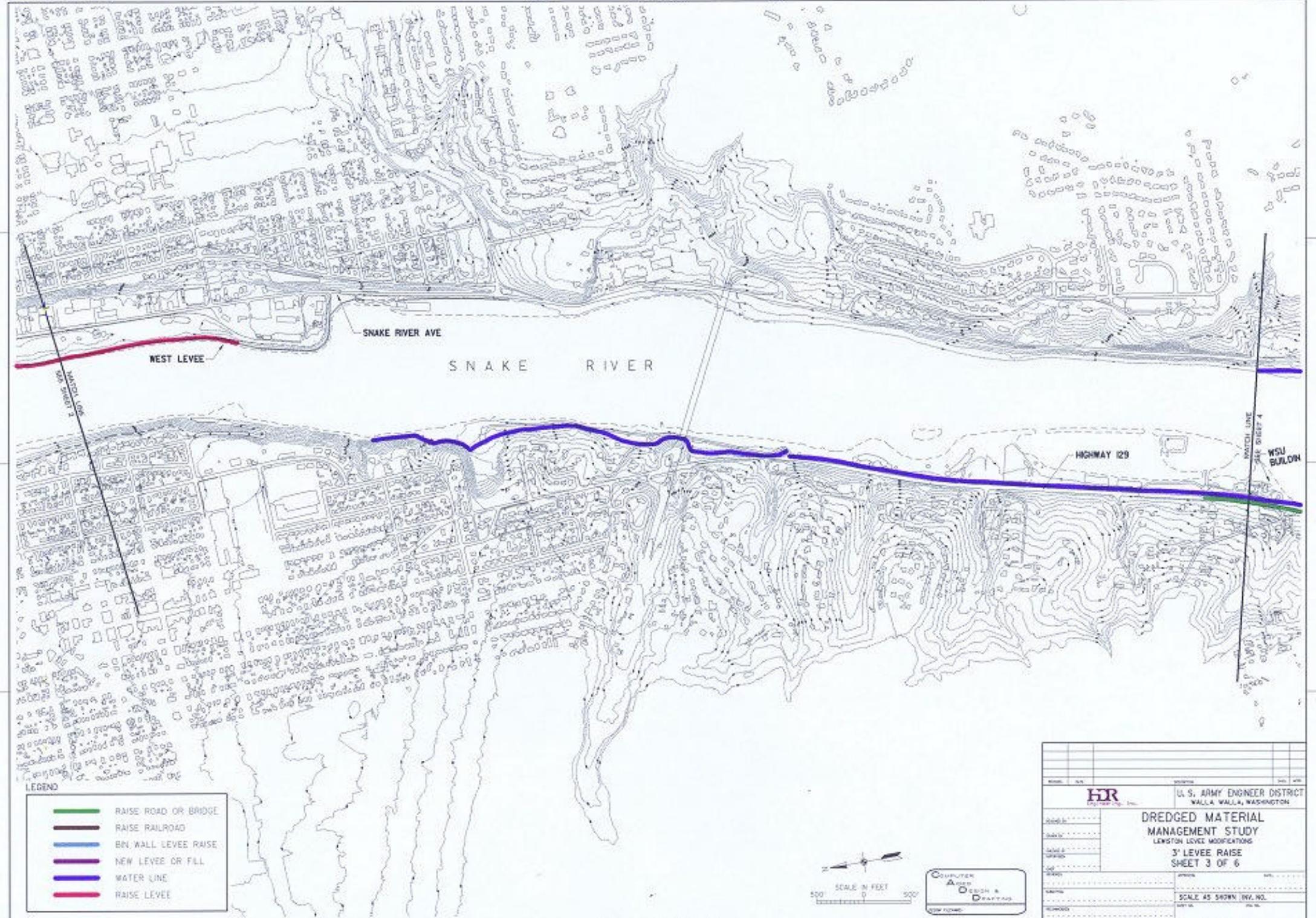
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<p>SED MATERIAL GEMENT STUDY ON LEVEE MODIFICATIONS</p>	
<p>LEVEE RAISE SHEET 1 OF 6</p>	
<p>SCALE AS SHOWN (INV. NO. ...)</p>	

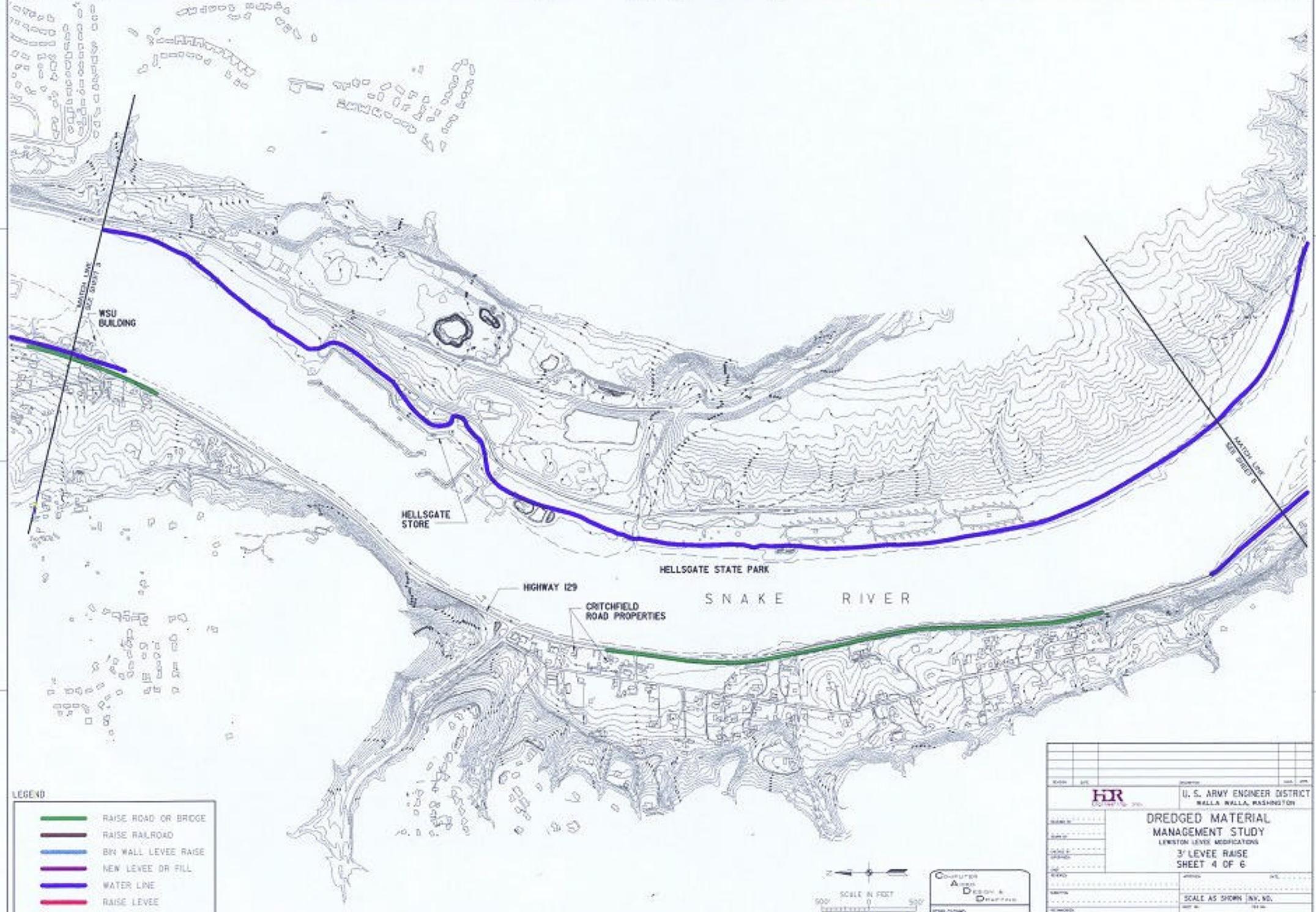


LEGEND

	RAISE ROAD OR BRIDGE
	RAISE RAILROAD
	BN WALL LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE

HR CORPORATION, INC.		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEWISTON LEVEE MODIFICATIONS			
3' LEVEE RAISE			
SHEET 2 OF 6			
DATE:	PROJECT:	SCALE AS SHOWN (INV. NO. 1414)	REV. NO.
SCALE IN FEET	COMPUTER AIDED DESIGN & DRAFTING		





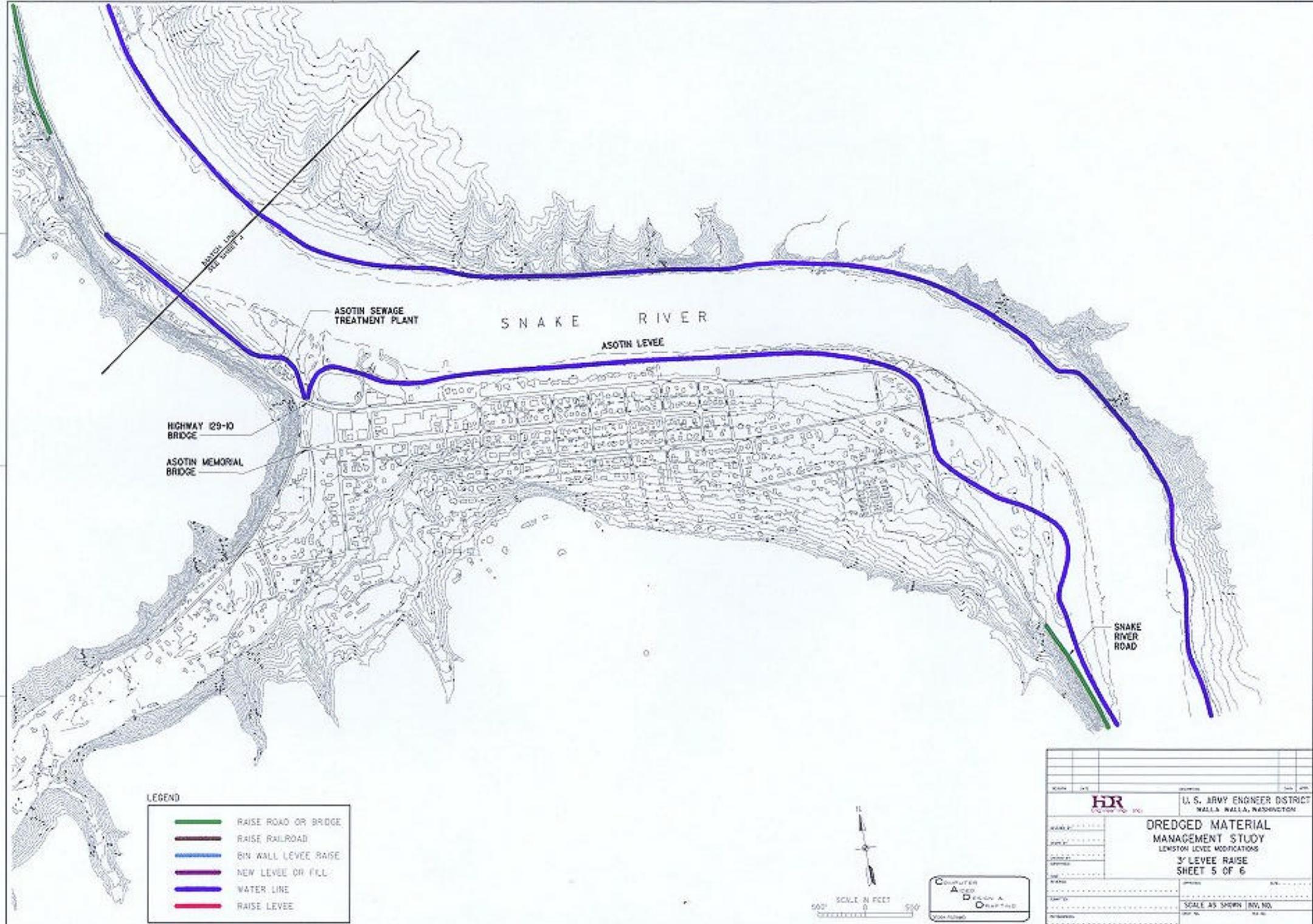
LEGEND

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	RAISE RAILROAD
	BN WALL LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE



Computer
A
Design &
Drafting

		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEWISTON LEVEE MODIFICATIONS			
3' LEVEE RAISE			
SHEET 4 OF 6			
DATE:		SCALE AS SHOWN (IN. VS. FT.)	
SCALE:			
PROJECT:			
DESIGNER:			
CHECKED:			
APPROVED:			



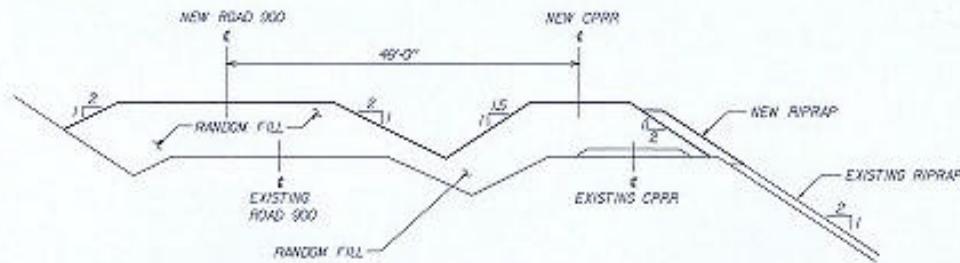
LEGEND

	RAISE ROAD OR BRIDGE
	RAISE RAILROAD
	BIN WALL LEVEE RAISE
	NEW LEVEE OR FILL
	WATER LINE
	RAISE LEVEE

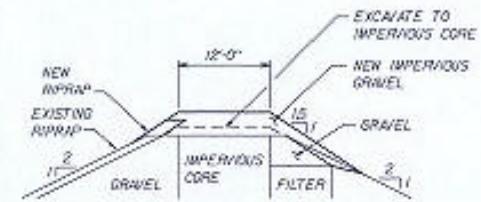


Computer
Aided
Design
DRAFTING

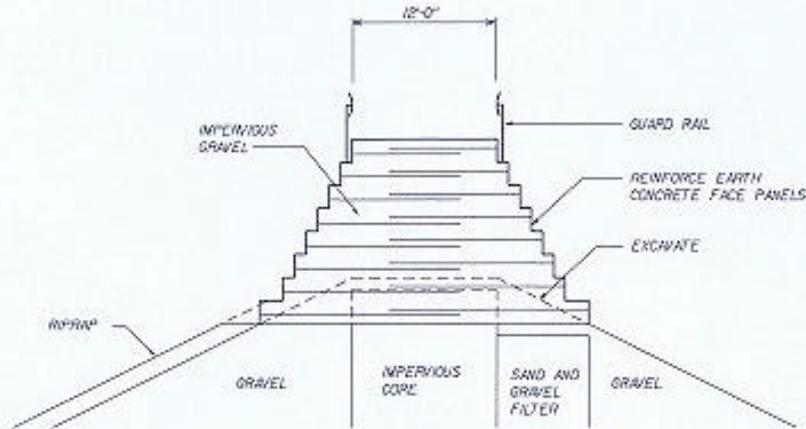
		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY			
LEVEE LEVEL MODIFICATIONS			
3' LEVEE RAISE			
SHEET 5 OF 6			
SCALE AS SHOWN	REV. NO.		



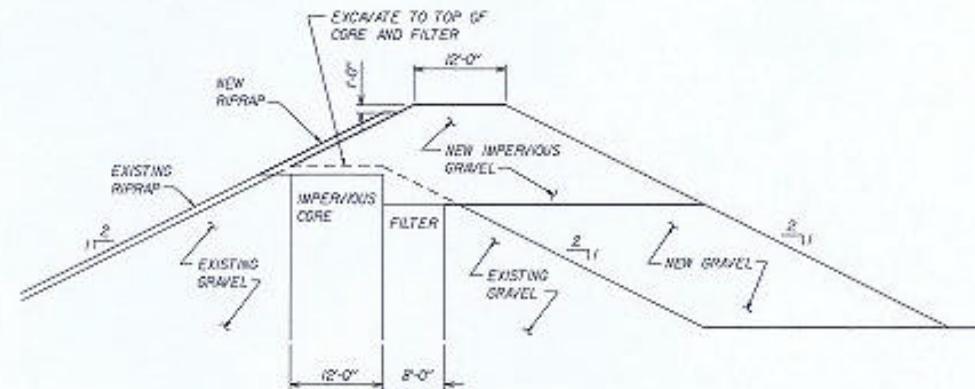
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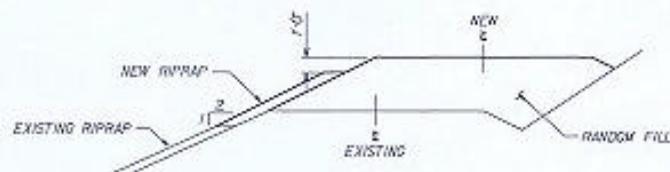
LEVEE RAISE < 2'



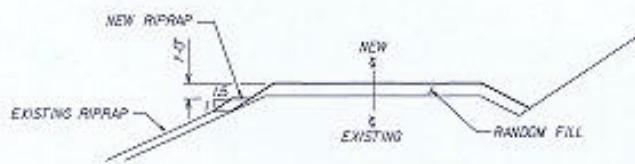
BIN WALL LEVEE RAISE



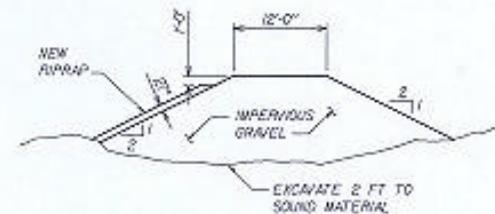
LEVEE RAISE > 2'



HIGHWAY 12



HIGHWAY 125



NEW LEVEE

Computer Aided Drafting

		U. S. ARMY ENGINEER DISTRICT WALLA WALLA, WASHINGTON	
DREDGED MATERIAL MANAGEMENT STUDY LENGTHEN LEVEE MODIFICATIONS TYPICAL SECTIONS			
DATE:	BY:	APP'D:	CHK'D:
SCALE:	SCALE AS SHOWN (HY. NO.)	DATE:	NO.: