

Water Preserve Areas Feasibility Study
Selected Plan
bird design region (Bird Drive Recharge Area)

Levee, Canals, Earth and Sitework

Submission to EN-C

Original Submission: 20 February 2001

1. Cost estimates are needed for design features associated with the Bird Drive Recharge Area within the Water Preserve Areas (WPA) Feasibility Study. This cost estimate will be used as the Selected Plan in the study.
2. The point of contact for this request is Mr. Keith Jones, at extension 1127. Let me know if I can be of more assistance.

Attachments Provided:

1. Spreadsheet Analysis Report (revised) - 3 pages
2. Geotechnical Data and Assumptions (revised) - 3 pages
3. 11" x 17" Layout Drawings - 2 pages
 - Site Layout (levees.dgn) shows design
 - Alignments/Locations (levees.dgn) - shows levee and canal centerlines, distances and areas used for calculation and cross section locations
4. Cross Section Profiles - 6 pages
5. bird Design Region Scope - 2 pages
 - Contains a comprehensive list of design and cost feature

**Water Preserve Areas Feasibility Study
Levees and Canals Summary of Material Quantities
Bird Drive Recharge Area and Design Region**

	Gross Volume cu-yds	Rock Volume cu-yds	Overburden Volume cu-yds	InRoads Volume cu-yds
Excavated Materials				
Conveyance or Seepage Canals	1972323	1869451	102872	
F&W Littoral Shelves	0	0	0	0
Intake and Discharge Basins	21911	21911	0	
Totals	1994234	1891362	102872	0
Amount reusable= 70%	1395964	1323953	72011	
Amount spoil= 30%	598270	567408	30862	
Quality Construction Material Required				
Fill Material Requirements	415515			0
Revetment - 12" Bedding Stone	0			
Revetment - 18" Rip Rap	0			
Spoil Material Disposal Areas				
Wind Breaks	0			
Borrow Pits/Mined Lakes	243430			
Fill Areas	3705			
Totals	247134			
Spoil Material Generated				
Excavated Materials	598270			
Totals	598270			

Notes: InRoads volumes not available at time of submission

**Water Preserve Areas Feasibility Study
Levees and Canals Summary of Material Quantities
Bird Drive Recharge Area and Design Region**

Excavation Requirements

Rock at Elevation = **5.5** ft-NGVD and below

Conveyance or Seepage Canals	Length feet	Inside Slope 1V on ?H	Outside Slope 1V on ?H	Bottom Width feet	Average Ground ft-NGVD	Canal Invert ft-NGVD	Canal Cut Depth feet	Cross Section Area sqft	Gross Volume cu-yds	Rock Volume cu-yds	Overburden Volume cu-yds	InRoads Length cu-yds	InRoads Volume cu-yds
C-504 Conveyance													
Reach #1	10370	1.0	1.0	50.0	5.0	-8.5	13.5	857	329248	329248	0		
Reach #2	14775	1.0	1.0	50.0	5.4	-8.5	13.9	888	486048	486048	0		
Reach #3	4935	1.0	1.0	50.0	6.2	-8.5	14.7	951	173838	163769	10069		
Reach #4	15360	1.0	1.0	50.0	7.3	-8.5	15.8	1040	591440	509724	81715		
Reach #5	5040	1.0	1.0	50.0	7.3	-8.5	15.8	1040	194066	167253	26813		
C-504 Totals	50480								1774640	1656042	118597		
C-504S Seepage Canal													
Reach #1	11655	3.0	3.0	10.0	4.9	-2.5	7.4	238	102858	102858	0		
Reach #2	6385	3.0	3.0	10.0	5.0	-2.5	7.5	244	57642	57642	0		
Reach #3	8185	3.0	3.0	10.0	5.2	-2.5	7.7	255	77263	77263	0		
Reach #4	5110	3.0	3.0	10.0	5.5	-2.5	8	272	51479	51479	0		
C-504S Totals	31335								289242	289242	0		
New Conveyance Canal Totals	81815								2063881	1945284	118597		
Existing Canals													
Existing C-1W Canal	5040	1.0	1.0	20.0	7.3	-7.0	14.3	490	91558	75833	15725		
Existing Canals Totals	5040								91558	75833	15725		
Note1: Existing C-1W Canal is subtracted from totals because it is along 5040' of the new alignment of C-504.													
New Conveyance Canals minus Existing Borrow Canals													
Totals									1972323	1869451	102872		

F&W Littoral Shelves	Length feet	Width feet	Area Acres	Average Ground ft-NGVD	Invert ft-NGVD	Cut Depth feet	Cross Section Area sqft	Gross Volume cu-yds	Rock Volume cu-yds	Overburden Volume cu-yds
Totals	0		0.0			0.0	0	0	0	0

Intake and Discharge Basins	Area sqft	Area Acres	Average Ground ft-NGVD	Invert ft-NGVD	Cut Depth feet	Gross Volume cu-yds	Rock Volume cu-yds	Overburden Volume cu-yds
S-520 Discharge Basin	41370	0.9	4.3	-10.0	14.3	21911	21911	0
Totals		0.9				21911	21911	0

**Water Preserve Areas Feasibility Study
Levees and Canals Summary of Material Quantities
Bird Drive Recharge Area and Design Region**

Fill Material Requirements

Levees	Length feet	Inside Slope 1V on ?H	Outside Slope 1V on ?H	Top Width feet	Average Ground ft-NGVD	Top of Levee ft-NGVD	Levee Height feet	Cross Section Area sqft	Gross Volume cu-yds	InRoads Length cu-yds	InRoads Volume cu-yds
Recharge Area L-504											
S-520 Discharge Basin	970	3.0	3.0	12	4.3	10.5	6.2	190	6816		
Northern Boundary	10615	3.0	3.0	12	5.5	10.5	5	135	53075		
East #1	2475	3.0	3.0	12	5.0	10.5	5.5	157	14369		
South and Eastern Boundary #1	17230	3.0	3.0	12	5.4	10.5	5.1	139	88849		
South and Eastern Boundary #2	6175	3.0	3.0	12	5.2	10.5	5.3	148	33818		
Western Boundary	15355	3.0	3.0	12	5.5	10.5	5	135	76775		
L-504 Totals	52820								273702		
Interior Berm along C-504											
Northern Boundary	10360	3.0	3.0	12	4.8	7.0	2.2	41	15701		
Western Boundary	14705	3.0	3.0	12	5.3	7.0	1.7	29	15832		
Interior C-504 Berm Totals	25065								31534		
Interior Mitigation Levee L-504M											
Eastern Boundary #1	9065	3.0	3.0	12	4.7	9.0	4.3	107	35948		
Southern Boundary #1	5025	3.0	3.0	12	5.0	9.0	4.0	96	17867		
Eastern Boundary #2	8255	3.0	3.0	12	5.2	9.0	3.8	89	27186		
Southern Boundary #2	5100	3.0	3.0	12	5.5	9.0	3.5	79	14875		
Western Boundary	4550	3.0	3.0	12	5.3	9.0	3.7	85	14403		
L-504M Totals	31995								110279		
Levee Totals	109880								415515		

Revetment	12" Bedding Stone					Rip Rap				
	Length feet	Width feet	Area acres	Depth feet	Gross Volume cu-yds	Length feet	Width feet	Area acres	Depth feet	Gross Volume cu-yds
Totals	0		0.0		0	0		0.0		0

Wind Breaks	Length feet	Inside Slope 1V on ?H	Outside Slope 1V on ?H	Top Width feet	Average Ground ft-NGVD	Top of Levee ft-NGVD	Levee Height feet	Cross Section Area sqft	Gross Volume cu-yds
Totals	0							0	0

Borrow Pits/Mined Lakes	Area sqft	Area acres	Bottom Depth ft-NGVD	Finished Depth ft-NGVD	Fill Depth feet	Gross Volume cu-yds
Totals	328630	7.5	-20.0		20.0	243430

Fill Areas	Length feet	Width feet	Area sqft	Area acres	Average Ground ft-NGVD	Finished Height ft-NGVD	Fill Depth feet	Gross Volume cu-yds
FPL Eastern Access Road	11895	15.0	16450	0.4	5.3	7.5	2.2	1340
FPL Western Access Road	5320	12.0	63840	1.5	6.5	7.5	1.0	2364
Totals	17215			1.8				3705

*** Geotechnical Data and Assumptions to Use for
Feasibility Level Cost Estimates (Amended 2/06/01)

Design Region: Bird Drive Basin Recharge Area

Notes:

1. Design region features for this area are levees for the recharge area and surrounding footprint, seepage and conveyance canals.
2. Levees are designed with minimal height so as minimize impacts to existing wetlands. Lower levee heights are planned for the design for the recharge area than would be planned for an impoundment that stores water. Modeling results have shown that depths in excess of 2' are not obtained because of the high permeability of the area.

Compaction Factor for Sandy Overburden:

Answer: 0.85

Swell Factor for Sandy Overburden:

Answer: 1.10

Compaction Factor for Rock:

Answer: 0.85

Swell Factor for Rock:

Answer: 1.30

Material Makeup of Levee Embankment:

Answer: Crushed rock from Canals/Fish refugia. This material must be crushed to a maximum particle size of 3 inches or less in order to utilize for levee construction. The rock will also need to be processed to produce a well-graded material for dam construction. A majority of the rock will be excavated from the adjacent conveyance canals. **It is estimated that overburden exists from ground surface to elevation +7.5 (only thin mantle of overburden exists which is probably less than 6 inches thick in many places). From +7.5 and deeper, mostly hard limestone is in place.**

NOTE: The 7.5 ft-NGVD elevation is obtained from core borings west of Krome Avenue. The Bird Drive Recharge Area is at elevations in the 5.0 to 5.5 ft-NGVD range.

*** Assumptions based upon limited subsurface information and prior projects, as of 2/06/01

Special Levee Construction Design Criteria:

Foundation Treatment:

Answer: Remove top 18 inches of overburden for levee width (overburden thickness is likely to be less than 6 inches in many places).

Seepage Control

Answer: None

Slope Protection:

Answer: None

Where the material will come from?

Answer: Material will be obtained from:

1. Usable excavated material from adjacent conveyance and seepage canals
2. Usable excavated material from construction of other WPA features in a 10 mile proximity of Bird Drive Recharge Area

Notes:

When constructing the levee, the Contractor will be required to utilize 12 inch lifts which then will be compacted down to 10 to 11 inches. Compaction requirements will be to 98% maximum dry density based upon standard proctor compaction tests or a nuclear density meter. Also, control of excessive moisture shall be the responsibility of the Contractor.

Excavation Procedure/Technique and/or Blasting Requirements (at this location only):

Answer: Assume some blasting of rock will be required (Rios from EN-G will supply blasting patterns/plan). After initial rock blasting some additional ripping will be required with backhoe with ripper attachment. Following blasting and ripping, normal excavation equipment may be utilized.

Percentage of Usable Excavated Overburden Soil Material:

Answer: Assume 70% of the material can be reused. The remaining 30% should be disposed of onsite or at an approved disposal area. Using excess unsuitable material

to build wind breaks, boat ramps or to flatten interior slopes is recommended also. The distribution of overburden soil versus rock is detailed above in red.

Percentage of Usable Excavated Rock Material:

Answer: Assume 70% of the material can be reused. The remaining 30% should be disposed of onsite or at an approved disposal area. Using excess unsuitable material to build wind breaks, boat ramps or to flatten interior slopes is recommended also. The distribution of overburden soil versus rock is detailed above in red.

Other Considerations:

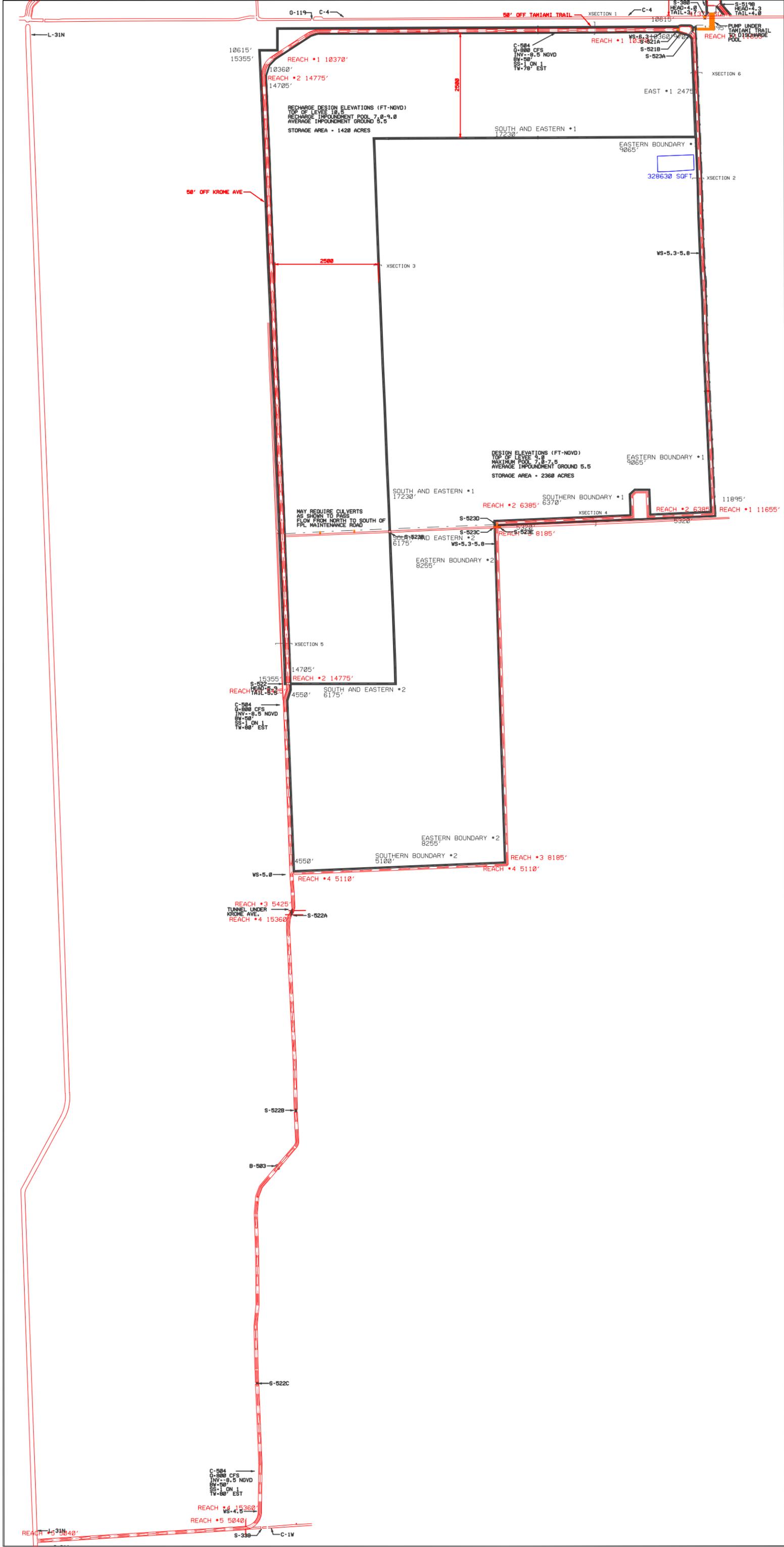
A rock crushing plant will be setup within the Recharge Area to process excavated material prior to placement.

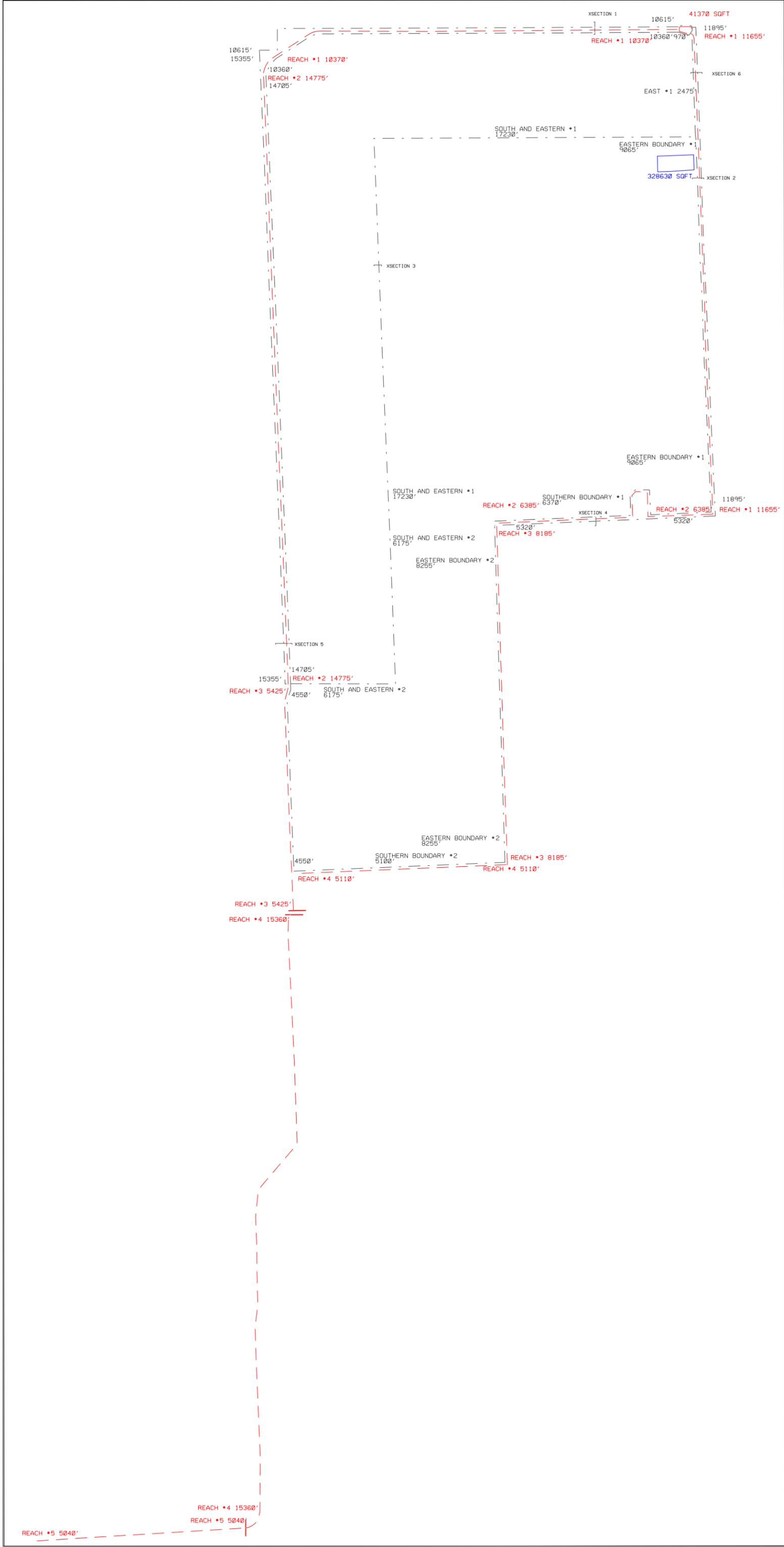
Assume overburden soils have a unit weight of 115 pcf while limestone has unit weight of 145 pcf for hauling purposes.

Geotechnical Instrumentation:

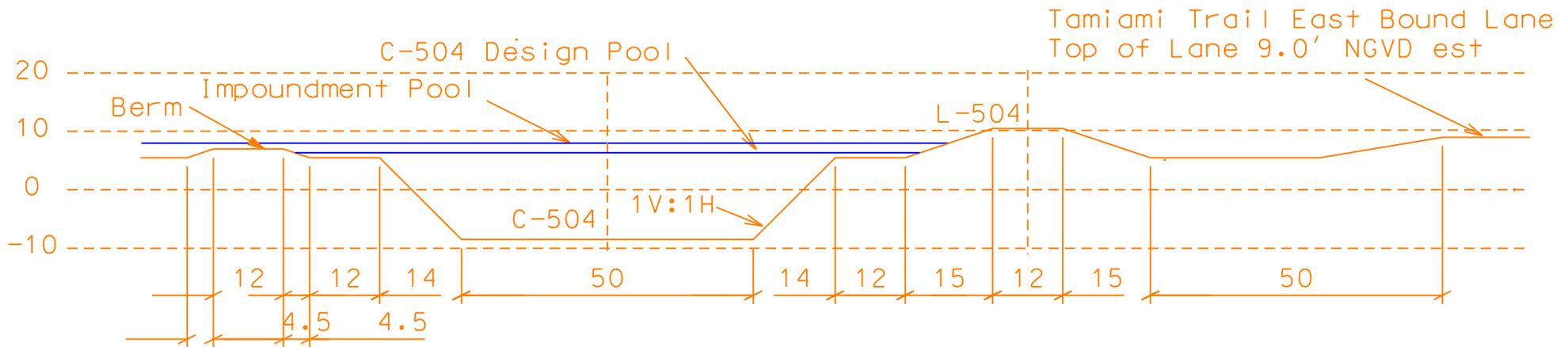
NOTE: This instrumentation is required for monitoring and operational safety of project features within the design region.

1. Shallow Depth Piezometers (\pm 5.0 feet from natural grade)
Answer: 3 piezometers included
2. Medium Depth Piezometers (greater than 5.0 and less than 50 feet from natural grade): 10 piezometers included
3. Deep Depth Piezometers (greater than 50 feet from natural grade): 3 piezometers included
4. Inclinometers: None
5. Others





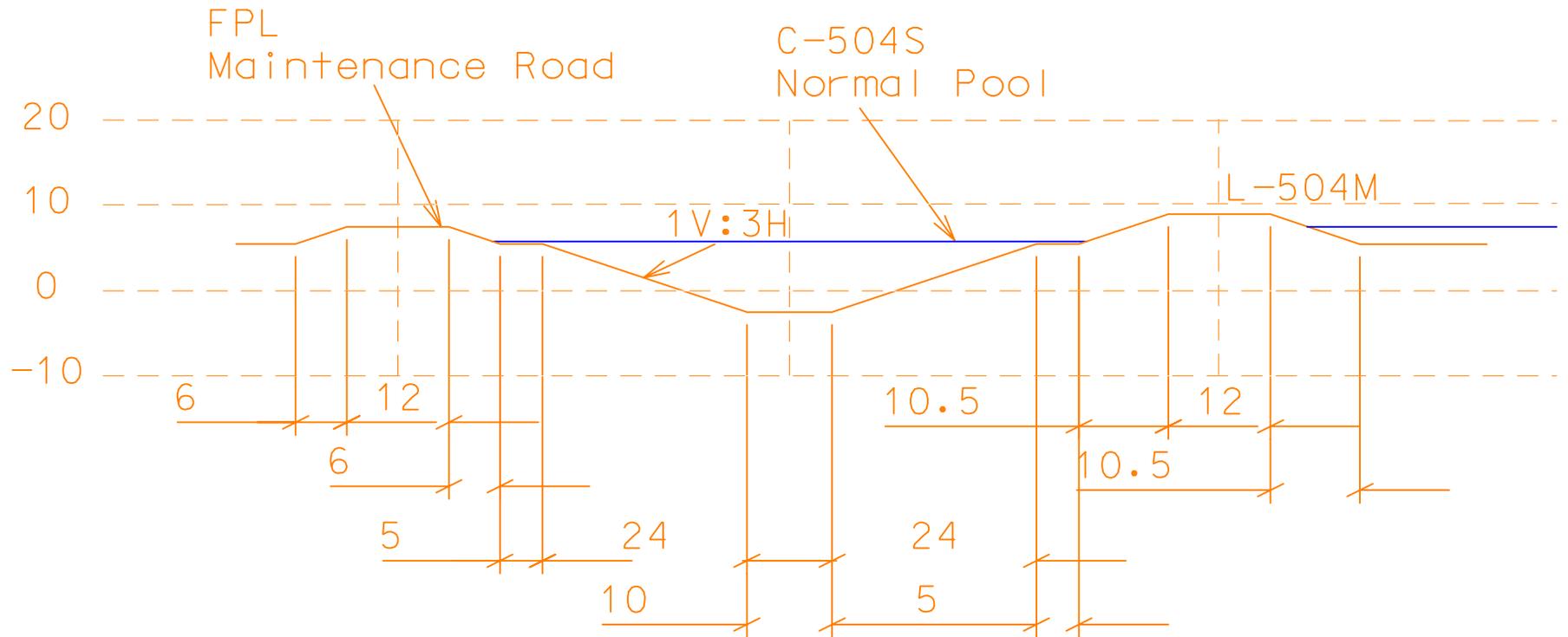
X-section 1
 Bird Drive Recharge Area
 Northern Boundary Along Tamiami Trail
 Looking West



Design Elevations (ft-NGVD)
 Top of Levee 10.5
 Recharge Impoundment Pool 7.0-9.0
 Top of Berm 7.0
 Normal C-504 Design Pool 6.3
 Average Impoundment Ground 5.5
 C-504 Bottom -8.5

Preliminary Design Slopes
 Outside Levee Slope = 1V:3H
 Inside Levee Slope = 1V:3H
 C-504 Slope = 1V:1H

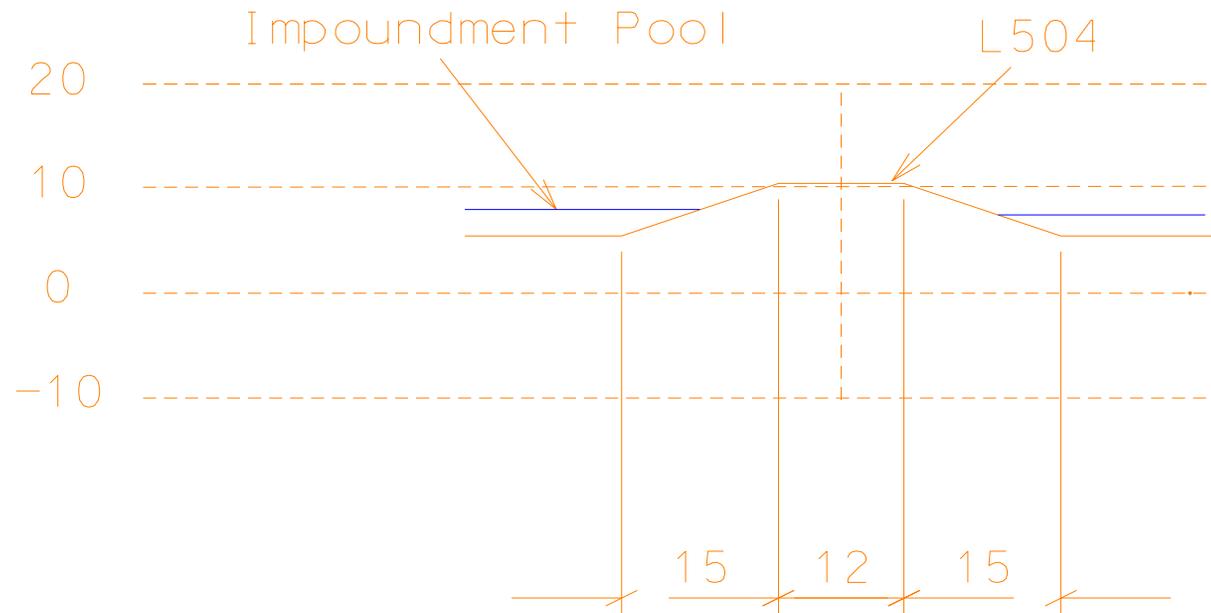
X-section 2
 Bird Drive Recharge Area
 Eastern Boundary
 Looking South



Design Elevations (ft-NGVD)
 Top of Levee 9.0
 Maximum Pool Depth 2.0 feet
 Maximum Pool Elev 7.0-7.5
 FPL Maintenance Road 7.5
 Seepage Canal Optimum 5.3-5.8
 Average Local Ground 5.5
 C-504S Bottom -2.5

Preliminary Design Slopes
 Outside Levee Slope = 1V:3H
 Inside Levee Slope = 1V:3H
 Discharge Pool Slope = 1V:3H

X-section 3
Bird Drive Recharge Area
Interior Levee
Looking North



Design Elevations (ft-NGVD)

Top of Levee 10.5

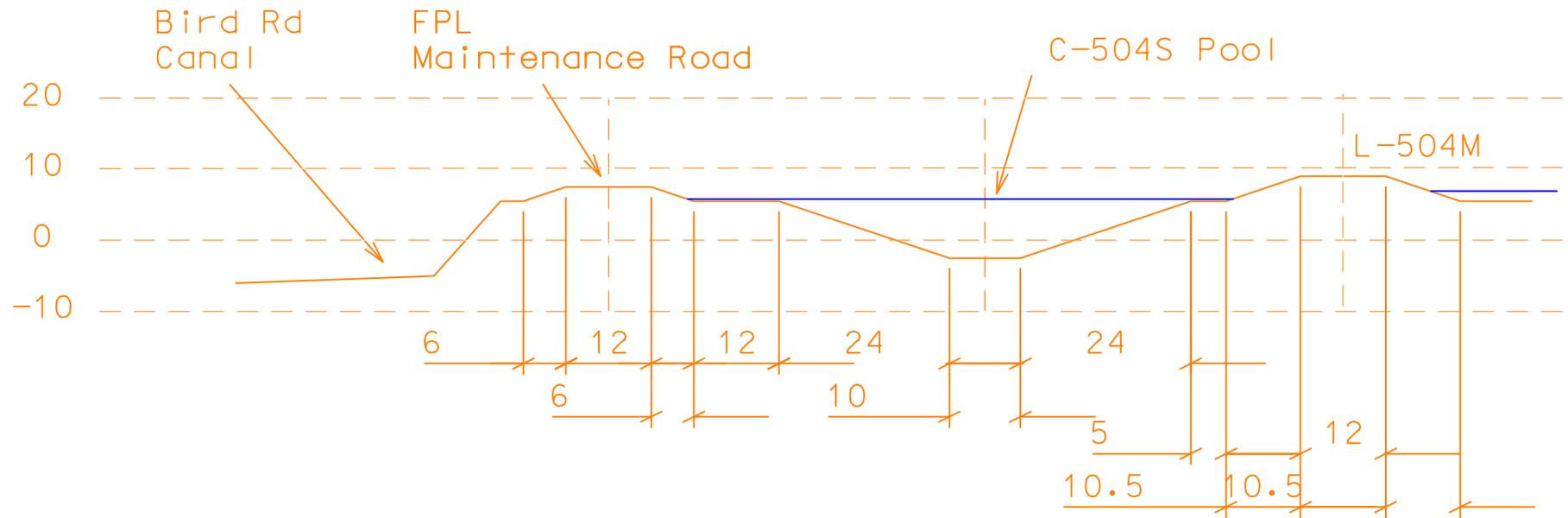
Recharge Impoundment Pool 7.0-9.0

Average Impoundment Ground 5.5

Preliminary Design Slopes

Levee Slope = 1V:3H

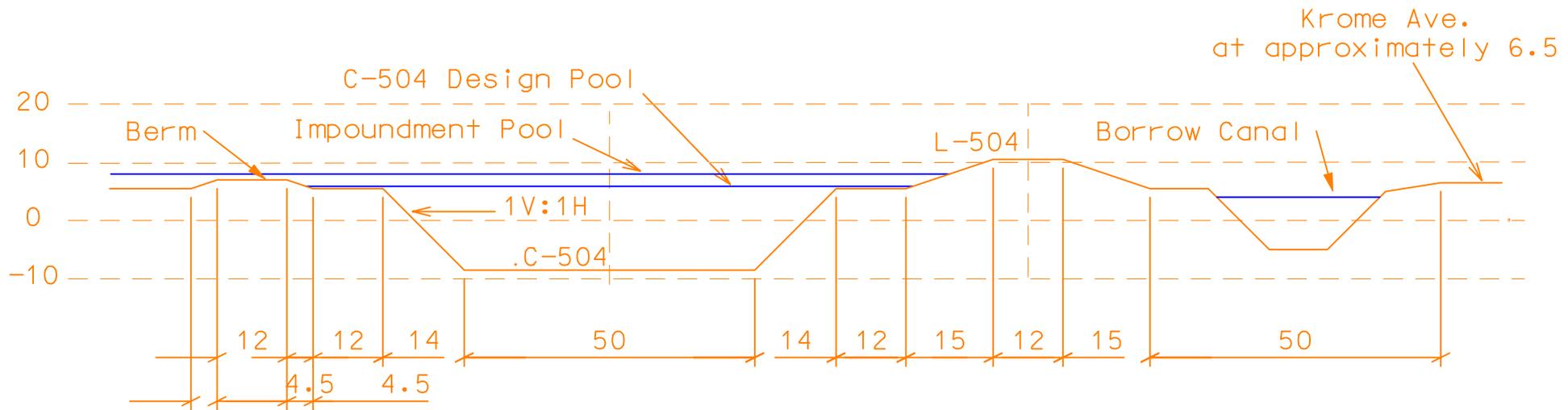
X-section 4
 Bird Drive Recharge Area
 Southern Boundary
 Looking West



Design Elevations (ft-NGVD)
 Top of Levee 9.0
 Maximum Pool Depth 2.0 feet
 Maximum Pool Elev 7.0-7.5
 FPL Maintenance Road Elevation 7.5
 Average Local Ground 5.5
 C-504S Design Pool 5.3-5.8
 C-504S Bottom -2.5

Preliminary Design Slopes
 C-504S Pool Slope = 1V:3H
 Road Slope = 1V:3H

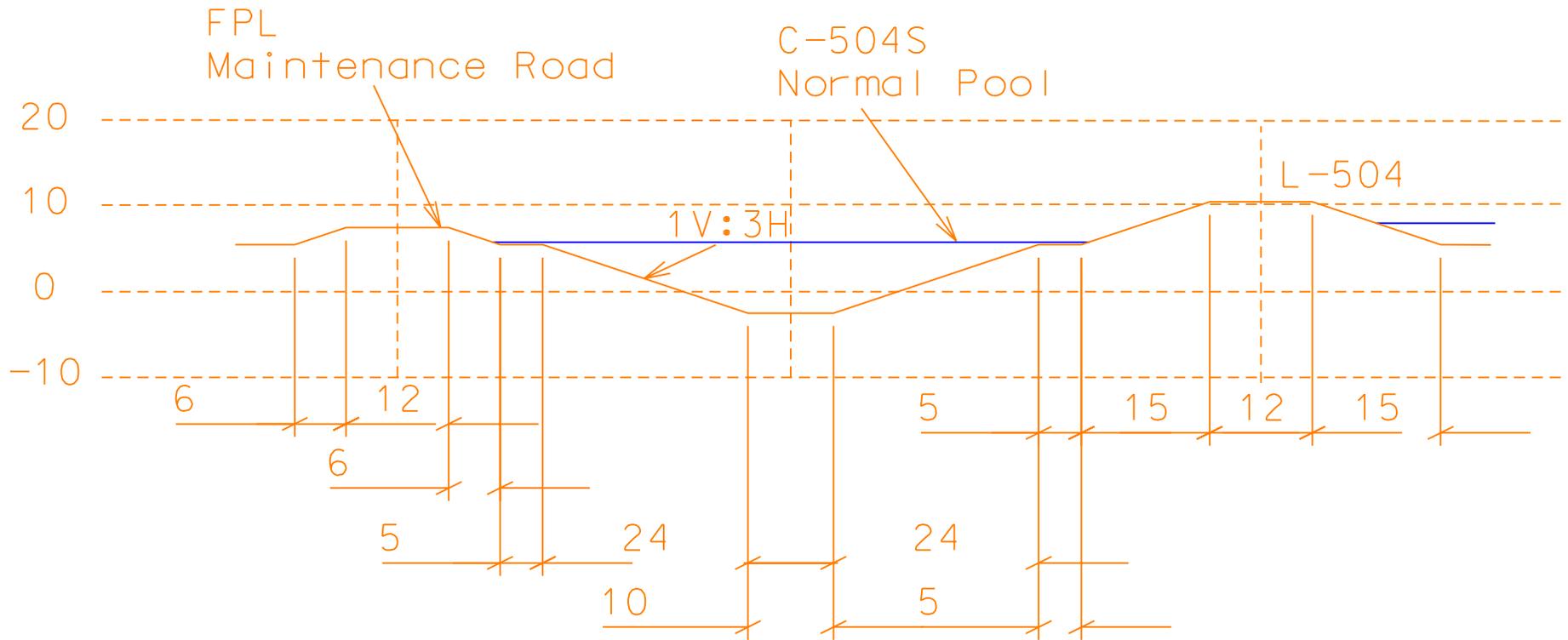
X-section 5
 Bird Drive Recharge Area
 Western Boundary
 Looking South



Design Elevations (ft-NGVD)
 Top of Levee 10.5
 Recharge Impoundment Pool 7.0-9.0
 Top of Berm 7.0
 C-504 Design Pool 5.9
 Average Local Ground 5.5
 Discharge Pool Bottom -8.5

Preliminary Design Slopes
 Outside Levee Slope = 1V:3H
 Inside Levee Slope = 1V:3H
 Discharge Pool Slope = 1V:1H

X-section 6
 Bird Drive Recharge Area
 Eastern Boundary
 Looking South



Design Elevations (ft-NGVD)
 Top of Levee 10.5
 Recharge Impoundment Pool 7.0-9.0
 FPL Maintenance Road 7.5
 Seepage Canal Optimum 5.3-5.8
 Average Local Ground 5.5
 C-504S Bottom -2.5

Preliminary Design Slopes
 Outside Levee Slope = 1V:3H
 Inside Levee Slope = 1V:3H
 Discharge Pool Slope = 1V:3H

Design Region: bird (Bird Drive Recharge Area)

Design:

- a) Design levees for 4' and 2' deep impoundment. Levees are designed with minimal height so as minimize impacts to existing wetlands. Lower levee heights are planned for the design for the recharge area than would be planned for an impoundment that stores water. Modeling results have shown that depths in excess of 2' are not obtained because of the high permeability of the area.
- b) Design gated culverts and a pump station for a 4' deep impoundment.
- c) Design pump stations for seepage control.
- d) Design SDCS conveyance canal C-504.
- e) Minor clearing and grubbing within 2' impoundment.

Recharge Area

Design Elevations (Ft-NGVD)

Top Of Levee 10.5

Recharge Impoundment Pool 7.0-9.0

Average Impoundment Ground 5.5

Storage Area = 1420 Acres

Mitigation Area

Design Elevations (Ft-NGVD)

Top Of Levee 9.0

Maximum Pool 7.0-7.5

Average Impoundment Ground 5.5

Storage Area = 2360 Acres

Pumps:

1. S-520 SDCS deliveries and Impoundment inflow
2. S-523A Seepage control pump at northeast corner
3. S-523B Seepage control pump for southern footprint area

Gated Culverts:

1. S-521A Discharge to C-504 inside 4' impoundment
2. S-521B 4' impoundment inflow
3. S-522 Impoundment discharge of C-504 inside 4' impoundment
4. S-523E Seepage control return and possible backpumping of Bird Road canal to the east
5. S-524 Impoundment compartment level control structures (have not resolved the need - see no requirement if transmissivity is as high as anticipated out of 4' impoundment)

Un-gated Culverts:

1. S-523C Seepage control and return of southeastern boundary
2. S-523D Seepage control and return of northeastern boundary

Levees:

1. L-504 Impoundment perimeter of 2'-4' depth area
2. L-504M 1' deep impoundment area around mitigation

Canals:

1. C-504 SDCS deliveries - 10,690' of canal is in close proximity of southbound lane of Krome Avenue where additional guardrail will be require
2. C-1W Improvement

Tunnels or Bridges:

1. S-522A C-504 crossing under Krome Ave
2. S-522B C-504 crossing under North Kendall Drive
3. B-503 Railroad crossing - C-504 crossing under S.C.L.R.R.
4. S-522C C-504 crossing under county road

Utilities:

1. Phone and electric

Issues:

1. Southern impoundment levee alignment will account for proximity to DERM wellfield.
2. Route of C-504 south of impoundment has several crossing to make depending on chosen path. The route will have to be carefully analyzed.