APPENDIX A—THREATENED AND ENDANGERED SPECIES

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Everglades National Park – Old Tamiami Trail Modifications
Special Status Species Lists and Dismissals

The species lists below were developed using the US Fish and Wildlife Service (USFWS) Information, Planning, and Consultation system (IPAC) as well as state species lists and other guidance provided the USFWS and park staff. The presence or absence of species within the project area was determined according to guidance from park biologists. Species that are not likely to occur in the project area or would not be affected by the proposed action were assigned a determination of "No effect" and were dismissed from further analysis, unless otherwise indicated. A full analysis of species assigned a determination other than "No effect" is provided in chapter 4 of the environmental assessment (EA).

Federal Species List

COMMON NAME*	SCIENTIFIC NAME	FEDERAL STATUS	CEPP EIS BA DETERMINATION	PRELIMINARY DETERMINATION	NOTES
Birds					
Bachman's warbler	*Vermivora bachmanii*	Endangered	Not assessed	No effect	Occurs in low, wet, forested areas. The last sighting of Bachman's warbler in Florida was reported in 1977.
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	Endangered	May affect, and is likely to adversely affect	Include in EA/BA for full analysis	Cape Sable seaside sparrows are not anticipated to be in the project area but flow through the structures under the trail is managed to enhance conditions for its habitat. The closest occupied Cape Sable seaside sparrow habitat is approximately 10 miles south of the project area.
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	Endangered	May affect, and is likely to adversely affect	Include in EA/BA for full analysis	Final Designated Critical habitat within the project area. Short-term, adverse impacts are expected to be limited to the timeframe of construction and Everglade snail kites would be expected to fully return to project area following completion of construction. Long-term benefits on habitat expected.
Florida grasshopper sparrow	*Ammodramus savannarum floridanus*	Endangered	Not assessed	No effect	Occurs in prairies. Not known to occur in the project area.

COMMON NAME*	SCIENTIFIC NAME	FEDERAL STATUS	CEPP EIS BA DETERMINATION	PRELIMINARY DETERMINATION	NOTES
Florida scrub-jay	*Aphelocoma coerulescens*	Threatened	Not assessed	No effect	Occurs in scattered, often small and isolated patches of sand pine scrub, xeric oak scrub, and scrubby flatwoods, which occur on well-drained, sandy ridges in peninsular Florida. They have very specific habitat requirements: short, shrubby oaks, open patches of sand, and few trees. Not known to occur in the project area.
Ivory-billed woodpecker	*Campephilus principalis*	Endangered	Not assessed	No effect	Occurs in riparian habitats. Not known to occur in the project area. No recent records in the park.
Kirtland's warbler	*Setophaga kirtlandii*	Endangered	Not assessed	No effect	Nest in Jack pine (*Pinus banksiana*) and inhabit dense scrub during the winter. Not known to occur in the project area. No recent records in the park.
Piping plover	*Charadrius melodus*	Threatened	No effect	No effect	Shorebird that occurs on the Gulf of Mexico and Atlantic coasts; habitat includes beaches, mudflats, and sandflats, as well as barrier island beaches and spoil islands. Not known to occur in the project area.
Red knot	*Calidris canutus rufa*	Threatened	Not assessed	No effect	Shorebird that occurs in coastal marine and estuarine habitats. Not known to occur in the project area.
Red-cockaded woodpecker	*Picoides borealis*	Endangered	No effect	No effect	Occurs in mature pine forests. Not known to occur in the project area. No recent records in the park.
Wood stork	*Mycteria americana*	Threatened	May affect, and is likely to adversely affect	Include in EA/BA for full analysis	No nests in project area, but could be temporary disturbance of foraging birds during construction resulting in temporary behavioral changes and changes in habitat use.
Ferns and Allies					
Florida bristle fern	*Trichomanes punctatum ssp. floridanum*	Endangered	No effect	No effect	Suitable habitat (sheltered rockland habitats) not present in project area.

COMMON NAME*	SCIENTIFIC NAME	FEDERAL STATUS	CEPP EIS BA DETERMINATION	PRELIMINARY DETERMINATION	NOTES
Fishes					
Smalltooth sawfish	*Pristis pectinata*	Endangered	May affect, but is not likely to adversely affect	No effect	Occurs at southern extent of Everglades, within coastal wetlands and nearshore habitats of the bay.
Flowering Plants					
Blodgett's silverbush	*Argythamnia blodgettii*	Threatened	No effect	No effect	This species occurs in pine rocklands of the Long Pine Key region of the park. This species is not found in project area.
Cape Sable thoroughwort	*Chromolaena frustrata*	Endangered	No effect	No effect	Occurs in open canopy habitats in coastal berms and coastal rock barrens, and in semi-open to closed canopy habitats, including buttonwood forests, coastal hardwood hammocks, and rockland hammocks. This species is restricted to the Flamingo region of the park and does not occur in the project area.
Crenulate lead-plant	*Amorpha crenulata*	Endangered	No effect	No effect	Occurs in plant communities that were historically associated with seasonally hydrated soils and frequent burning, including wet pinelands, transverse glades, and hammock edges; current distribution is within a 20 square mile area from Coral Gables to Kendall, Miami-Dade County. Formally cultivated in the park, but is no longer present.
Everglades bully	*Sideroxylon reclinatum ssp. austrofloridense*	Proposed Threatened	Not assessed	No effect	Within the park, Everglades bully is found in pinelands, pineland/prairie ecotones, and marl prairies. This species does not occur in project area.
Florida Pineland crabgrass	*Digitaria pauciflora*	Proposed Threatened	No effect	No effect	Occurs in pine rocklands, marl prairies, and in the ecotone between the two habitats within the Long Pine Key region of the park in Miami-Dade County and the Lostman's Pines region of Big Cypress National Preserve in mainland Monroe County. This species does not occur in project area.

COMMON NAME*	SCIENTIFIC NAME	FEDERAL STATUS	CEPP EIS BA DETERMINATION	PRELIMINARY DETERMINATION	NOTES
Florida prairie-clover	*Dalea carthagenensis floridana*	Proposed Endangered	No effect	No effect	Occurs in pine rocklands, edges of rockland hammocks, coastal uplands, and marl prairie; only 5 populations are known, with a total of fewer than 1,000 plants; all are in conservation areas. In the park, Florida prairie clover was collected once in the Context Road area of East Everglades. This species is considered extirpated from the park flora and does not occur in the project area.
Garber's spurge	*Chamaesyce garberi*	Threatened	May affect, but is not likely to adversely affect	No effect	This species is restricted to pine rocklands of Long Pine Key and coastal grasslands of Cape Sable region of the park. Does not occur in project area.
Pineland sandmat	*Chamaesyce deltoidea pinetorum*	Proposed Threatened	No effect	No effect	This species is restricted to pine rocklands of Long Pine Key region of the park. Does not occur in project area.
Insects					
Bartram's hairstreak butterfly	*Strymon acis bartrami*	Endangered	No effect	No effect	This species is restricted to pine rocklands of the Long Pine Key region of the park and does not occur in project area.
Florida leafwing butterfly	*Anaea troglodyta floridalis*	Endangered	No effect	No effect	This species is restricted to pine rocklands of the Long Pine Key region of the park and does not occur in project area.
Miami blue butterfly	*Cyclargus (=hemiargus) thomasi bethunebakeri*	Endangered	No effect	No effect	Inhabits tropical hardwood hammocks and their associated margins, beachside scrub, and tropical pine rocklands. Miami blue butterfly is currently considered extirpated from the park.

COMMON NAME*	SCIENTIFIC NAME	FEDERAL STATUS	CEPP EIS BA DETERMINATION	PRELIMINARY DETERMINATION	NOTES
Mammals					
Florida bonneted bat	*Eumops floridanus*	Endangered	No effect	No effect[a]	Not known to occur in the project area. Visual survey of the area in 2017 did not detect any evidence of bats, potential roosting sites, or bat evidence (e.g., guano). Closest known location for bonneted bats in relation to the project area is approximately 11 miles from the Shark Valley Entrance Road. The bonneted bat was included in the EA analysis at the request of USFWS.
Florida panther	*Puma (=felis) concolor coryi*	Endangered	May affect, but is not likely to adversely affect	Include in EA/BA for full analysis	Project would result in loss of potential habitat through conversion of upland habitat that could be potentially used by Florida panther to transverse the area to wetland habitat (CEPP). However, the project area is not the preferred habitat, and panthers are not known to occur in the area.
West Indian manatee (Florida manatee)	*Trichechus manatus*	Endangered	May affect, but is not likely to adversely affect	May affect, but is not likely to adversely affect	Unlikely to be found in project area. In 1971, a manatee carcass was found 4.7 miles east of the L-67 extension canal. This was prior to the installation of gates in some of the canals that allowed manatees to enter some of the interior canals. The likelihood of that happening now would be extremely minimal.
Reptiles					
American alligator	*Alligator mississippiensis*	Similarity of Appearance (Threatened)	May affect, but is not likely to adversely affect	No effect	Alligators would be present in project area but are highly mobile and would avoid project area during construction activity.
American crocodile	*Crocodylus acutus*	Threatened	May affect, but is not likely to adversely affect	No effect	Occurs in coastal areas. Not known to occur in the project area.
Eastern indigo snake	*Drymarchon corais couperi*	Threatened	May affect, and is likely to adversely affect	Include in EA/BA for full analysis	Potential to occur, although there are no known occurrences in the project area. Not likely to occur in project area due to the extent of surrounding wetland habitat.

COMMON NAME*	SCIENTIFIC NAME	FEDERAL STATUS	CEPP EIS BA DETERMINATION	PRELIMINARY DETERMINATION	NOTES
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	May affect, but is not likely to adversely affect	No effect	Occurs at southern extent of Everglades, within nearshore habitats of the bay. Not known to occur in the project area.
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	May affect, but is not likely to adversely affect	No effect	Occurs at southern extent of Everglades, within nearshore habitats of the bay. Not known to occur in the project area.
Loggerhead sea turtle	*Caretta caretta*	Threatened	May affect, but is not likely to adversely affect	No effect	Occurs at southern extent of Everglades, within nearshore habitats of the bay. Not known to occur in the project area.
Snails					
Stock Island tree snail	*Orthalicus reses*	Threatened	No effect	No effect	Occurs in tropical hardwood hammocks.
Critical Habitat					
Everglade Snail Kite Critical Habitat		Final designated	May affect, and is likely to adversely affect	Include in EA/BA for full analysis	Final designated critical habitat within the project area. Long-term benefits to habitat expected. See figure A-1.

[a] Included in full analysis based on agency recommendation.

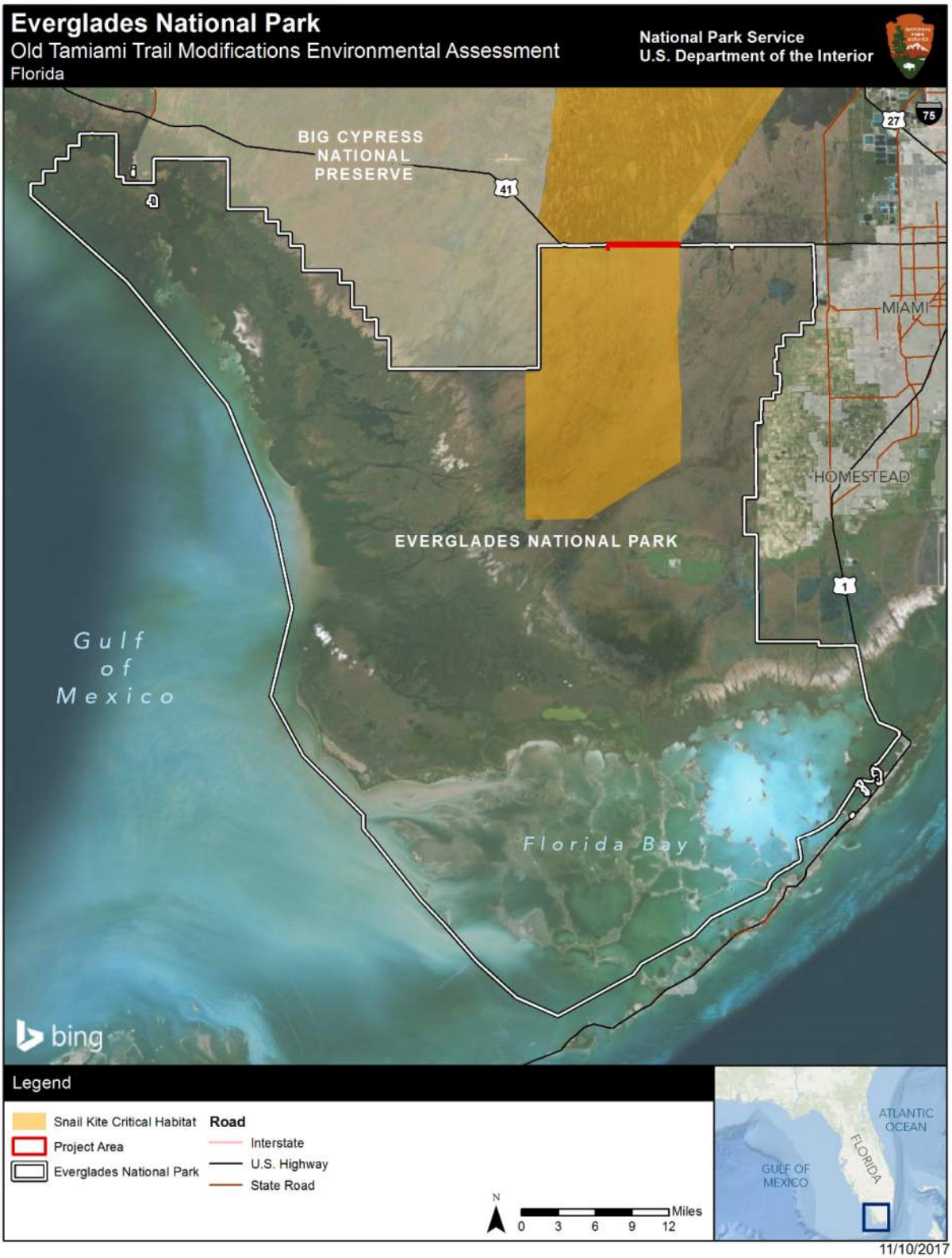

FIGURE A-1. SNAIL KITE CRITICAL HABITAT

Everglades National Park – Old Tamiami Trail Modifications

State Listed Species (not already included on Federal Species List)

COMMON NAME	SCIENTIFIC NAME	STATE STATUS	PRELIMINARY DETERMINATION	NOTES
Birds				
Marsh wrens	*Cistothorus palustris spp.*	Species of Special Concern	No effect	Not reported as breeding within Northeast Shark River Slough, the park, and not likely to occur in project area.
Little blue heron	*Egretta caerulea*	Threatened	Include in EA for full analysis	Project could result in impacts to nesting, loafing, roosting, and foraging habitat.
Reddish egret	*Egretta rufescens*	Threatened	Include in EA for full analysis	Previously observed within the freshwater marshes of the park but limited use of habitat in the project area. Potential to occur in Northeast Shark River Slough but the park does not constitute key breeding grounds.
Tricolored heron	*Egretta tricolor*	Threatened	Include in EA for full analysis	Project would result in impacts on nesting, loafing, roosting, and foraging habitat.
Southeastern American kestrel	*Falco sparverius paulus*	Threatened	Include in EA for full analysis	Not reported as breeding in Northeast Shark River Slough, the park, but previously observed within the freshwater marshes of the park. Not likely, but potential to occur in Northeast Shark River Slough.
Florida sandhill crane	*Grus canadensis pratensis*	Threatened	Include in EA for full analysis	Occurs in freshwater marshes, prairies, and pastures. Relatively uncommon in the park but previously observed in freshwater marshes of the park and have also previously bred in the park. Not likely, but potential to occur/ breed/forage in Northeast Shark River Slough.
White-crowned pigeon	*Patagioenas leucocephala*	Threatened	Include in EA for full analysis	Limited use of habitat in freshwater marshes of the park; not breeding in the project area.
Roseate spoonbill	*Platalea ajaja*	Threatened	Include in EA for full analysis	Previously observed in the freshwater marshes of the park but limited use of habitat in the project area. Potential to occur in Northeast Shark River Slough, but the park does not constitute key breeding grounds.

COMMON NAME	SCIENTIFIC NAME	STATE STATUS	PRELIMINARY DETERMINATION	NOTES
Snowy plover	*Charadrius alexandrius*	Threatened	No effect	Shorebird that utilizes coastal beaches.
Least tern	*Sterna antillarum*	Threatened	No effect	Shorebird that utilizes coastal beaches.
American oystercatcher	*Haematopus palliates*	Threatened	No effect	Shorebird that utilizes coastal beaches.
Black skimmer	*Rynchops niger*	Threatened	No effect	Shorebird that utilizes coastal beaches.
Osprey	*Pandion haliaetus*	Species of Special Concern	No effect	Occurs in coastal habitats and freshwater lakes and rivers.
Mammals				
Everglades mink	*Mustela vison evergladensis*	Threatened	No effect	Not detected in a recent wildlife camera monitoring study conducted near the Tamiami Trail culverts. Not likely to occur in project area.
Big Cypress fox squirrel	*Sciurus niger avicennia*	Threatened	No effect	Occurs in pine forests, cypress swamp forests, tropical hardwood forests, oak woodlands, coastal broadleaf evergreen hammocks, and mangrove swamps; found west of the park.
Sherman's fox squirrel	*Sciurus niger shermani*	Species of Special Concern	No effect	Occurs in the open piney woods of central and northeastern Florida.
Reptiles				
Rim rock crowned snake (Miami black headed snake)	*Tantilla oolitica*	Threatened	No effect	Occurs along the southeastern Atlantic Coast of Florida and the Keys in tropical hardwood hammocks and pine rocklands with shallow, sandy soils over underlying limestone, near fresh water.
Gopher tortoise	*Gopherus polyphemus*	Threatened	No effect	Occurs in well-drained sandy areas

COMMON NAME	SCIENTIFIC NAME	STATE STATUS	PRELIMINARY DETERMINATION	NOTES
Plants				
Pine-pink orchid	*Bletia purpurea*	Threatened	No effect	Species is found near swamps or freshwater marshes. If present in the project area, this species would not be restricted in distribution or otherwise vulnerable from removing the old Tamiami Trail roadbed and restoring wetlands. Therefore, it was not carried forward for analysis.
Lattice-vein fern	*Thelypteris reticulata*	Endangered	No effect	Occurs in Frog Pond natural area.
Wright's Pineland Fern	*Anemia wrightii*	Endangered	No effect	Occurs in Frog Pond natural area.
Mexican vanilla plant	*Vanilla mexicana*	Endangered	No effect	Occurs on tree islands in the upper Southern Glades region.
Eaton’s spikemoss	*Selaginella eatonii*	Endangered	No effect	

Other Species of Concern

One additional plant species that could occur in the project area is water horn fern (*Ceratopteris pteridoides*). This species is not listed by any regulatory agency but is considered critically imperiled in South Florida (SF1) by the Institute for Regional Conservation and a species of management concern by Everglades National Park biologists. Within Everglades National Park, water horn fern is only known to occur within the borrow canal adjacent to Shark Valley Tram Road. The species was last documented in 2007 within a stretch of the canal approximately 1 mile (1.5 km) south of the fee station. Surveys for this species have been conducted on a few occasions since 2007, the most recent of which took place in March 2017. No plants were detected. Therefore, this species is not expected to be present in the project area and was not carried forward for analysis. Mitigation to prevent adverse effects should the species be present is included in the EA.

APPENDIX B—PRELIMINARY SITE DESIGN

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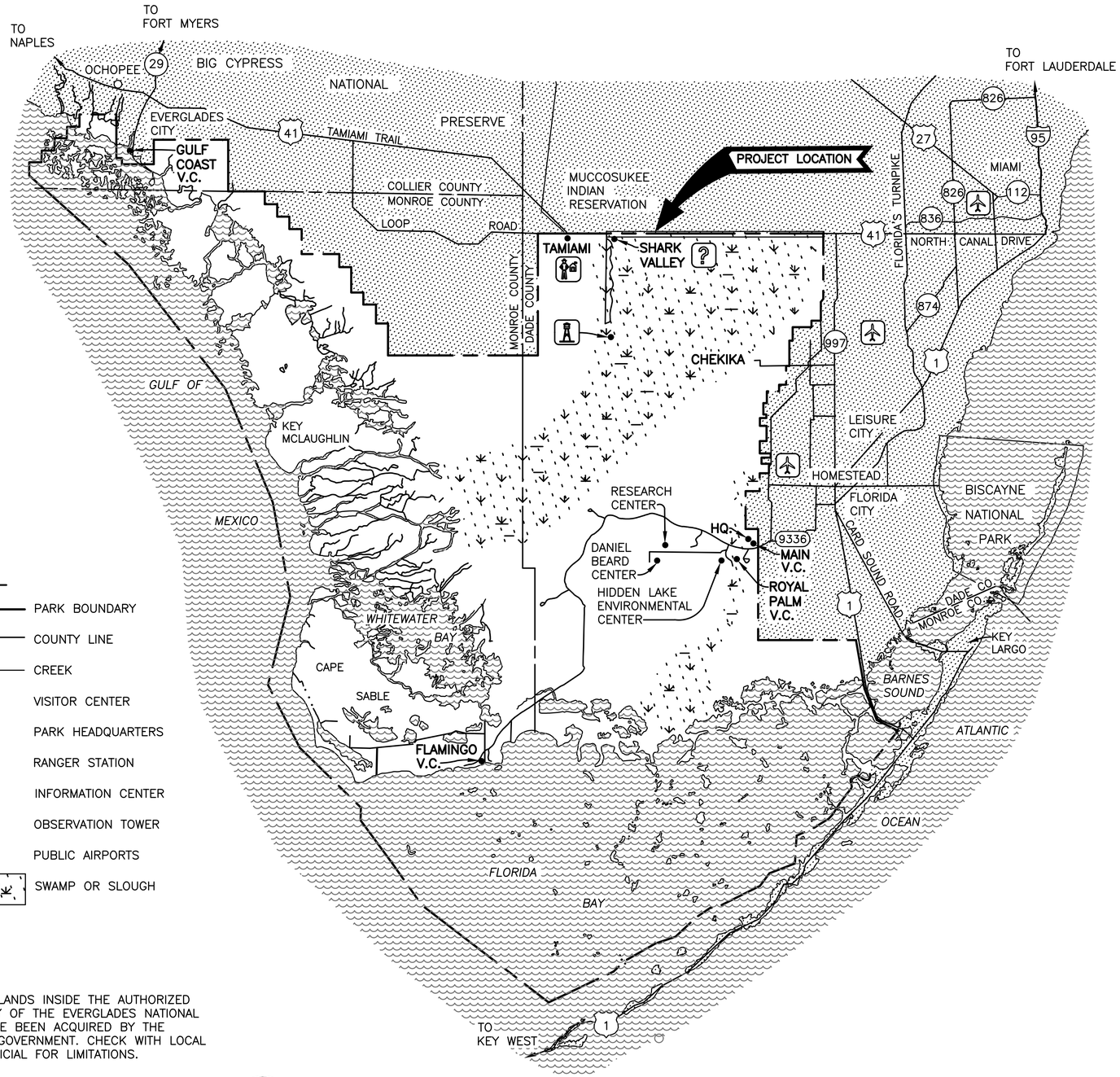

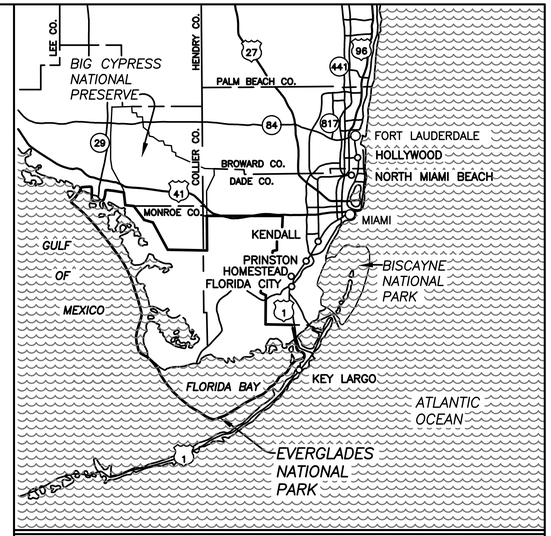

SOUTHERN FLORIDA

10 0 10 20
SCALE OF MILES

LEGEND

- PARK BOUNDARY
- COUNTY LINE
- CREEK
- V.C. VISITOR CENTER
- HQ. PARK HEADQUARTERS
- RANGER STATION
- INFORMATION CENTER
- OBSERVATION TOWER
- PUBLIC AIRPORTS
- SWAMP OR SLOUGH

NOTE
NOT ALL LANDS INSIDE THE AUTHORIZED BOUNDARY OF THE EVERGLADES NATIONAL PARK HAVE BEEN ACQUIRED BY THE FEDERAL GOVERNMENT. CHECK WITH LOCAL PARK OFFICIAL FOR LIMITATIONS.

EVERGLADES NATIONAL PARK
WORLD HERITAGE SITE

SCALE OF MILES
5 0 5 10
5 0 5 10 15
SCALE OF KILOMETERS

Mark	Sheet	REVISION	Date	Initial

QUALITY DESIGN CERTIFICATION
- ☐ Prepared in Accordance with Design Development (Title I) ____ Drawing No.
  OR
- ☐ Variance from Design Development (Title I) Approved by Superintendent on ____ Date
  OR
- ☐ Construction Drawing Not Preceded by Design Development (Title I)

Project Manager ____ Date

30% DESIGN PLANS NOT FOR CONSTRUCTION

UNITED STATES
DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE
DENVER SERVICE CENTER

TITLE OF DRAWING
OLD TAMIAMI TRAIL MODIFICATIONS
LOCATION WITHIN PARK
SHARK VALLEY
NAME OF PARK
EVERGLADES NATIONAL PARK
REGION SOUTHEAST | COUNTY MIAMI | STATE FLORIDA

DWG NO. 233902
PMIS. NO. EVER 160/1 39363
SHEET 1 OF 58

BASIC DATA: BOUNDARY MAPS 160/20,013B 9/89; 160/20,012 3/85; PARK MINI FOLDER 1992; REVISED & REDRAWN 5/93. UPDATED 11/98. SGS.

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53	ALTERNATIVE 2 - C327-C328 -
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58	TYPICAL SECTIONS - ALTERNATIVE 2

ABBREVIATIONS

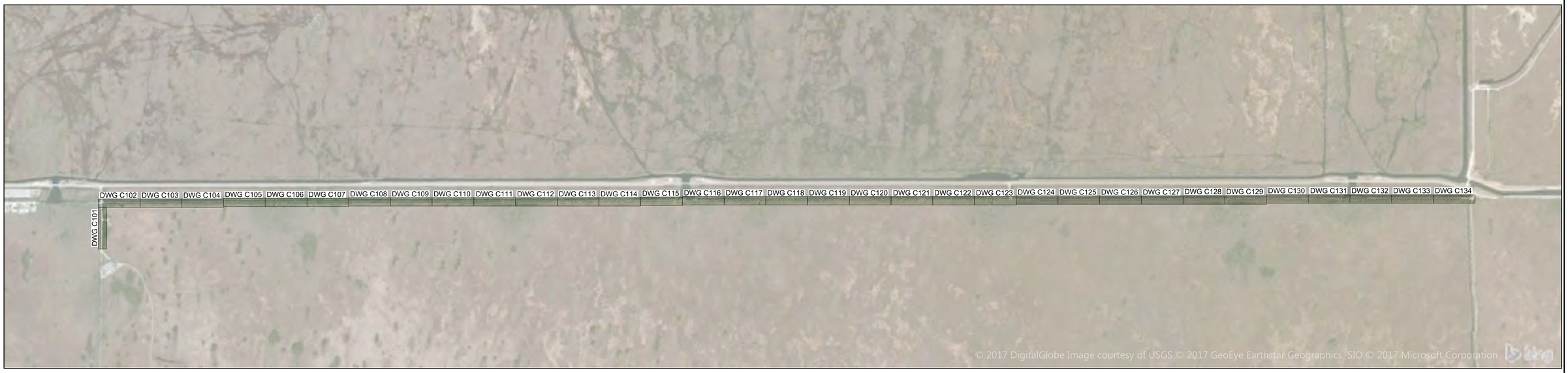
BOT.	BOTTOM
CMP	CORRUGATED METAL PIPE
CONC.	CONCRETE
EDR	EDGE OF DIRT ROAD
EP	EDGE OF ASPHALT PAVEMENT
EL.	ELEVATION
EOP	EDGE OF PAVEMENT
FND.	FOUND
GB	GRADE BREAK
GND	NATURAL GROUND
INV.	INVERT
IR&C	IRON ROD & CAP
LM	LOW MEMBER
NO.	NUMBER
PK	PARKER KALON NAIL
P.L.S.	PROFESSIONAL LAND SURVEYOR
RT.	RIGHT
STA.	STATION
-TOB-	TOP OF BANK
-TOE-	TOE OF SLOPE

GENERAL NOTES

1. THE HORIZONTAL COORDINATE SYSTEM IS THE FLORIDA STATE PLANE, EASY ZONE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983, U.S SURVEY FEET (NAD83, FT).
2. ALL ELEVATIONS SHOWN ARE IN NORTH AMERICAN VERTICAL DATUM OF 1988, FEET (NAVD88, FT).
3. THE TOPOGRAPHIC BASE SURVEY (OLD TAMIAMI ROAD LIMIT) WAS CONDUCTED BY BETSY LINDSAY, INC. IN NOVEMBER 2015. SUBSEQUENT SURVEY REVISIONS COMPLETED JANUARY 2016.
4. BATHYMETRIC TOPOGRAPHY OF THE OLD TAMIAMI ROAD CANAL WAS CREATED FROM THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT STRUCTURE–12D DRAWING PRODUCED IN FEBRUARY, 2006.
5. THE INFORMATION SHOWN ON THESE PLANS CONCERNING TYPE AND LOCATION OF UNDERGROUND UTILITIES IS NOT GUARANTEED TO BE ACCURATE OR ALL INCLUSIVE. THE CONTRACTOR IS RESPONSIBLE FOR MAKING HIS OWN DETERMINATIONS AS TO THE TYPE AND LOCATION OF UNDERGROUND UTILITIES AS MAY BE NECESSARY TO AVOID DAMAGE THERETO. ANY DAMAGE TO UTILITIES WILL BE REPAIRED IMMEDIATELY AT THE CONTRACTOR'S EXPENSE.
6. THE CONTRACTOR SHALL, DURING CONTRACT OPERATIONS, ADHERE TO ALL CONDITIONS SET FORTH IN THE PERMITS.
7. CONSTRUCTION VEHICLES AND STOCKPILE/STORAGE AREAS ARE NOT PERMITTED BEYOND THE LIMITS OF PROPOSED WORK.
8. ANY AREAS DISTURBED OUTSIDE THE DESIGNATED LIMITS OF DISTURBANCE SHALL BE RESTORED TO EXISTING CONDITIONS AT THE CONTRACTOR'S EXPENSE.
9. EXISTING TREES WITHIN THE LIMITS OF DISTURBANCE WHICH MIGHT BE DAMAGED DURING CONSTRUCTION SHALL BE PROTECTED BY A 6 FOOT HIGH FENCE, SECURELY ERECTED A MINIMUM OF 5 FEET FROM THE TRUNK OF THE INDIVIDUAL TREES OR FOLLOW THE OUTER PERIMETER OF BRANCHES OR CLUMPS OF TREES. ANY TREE THAT IS DAMAGED DURING THE WORK UNDER THIS CONTRACT SHALL BE REPLACED IN KIND OR AS APPROVED BY THE CO.
10. THE PROJECT SITE IS SUBJECT TO SHEET FLOW AND SEASONAL FLUCTUATIONS IN WATER LEVELS. THE CONTRACTOR MUST TAKE THIS UNDER CONSIDERATION WHEN PLANNING CONSTRUCTION ACTIVITIES TO ACCOUNT FOR THE VARIATION IN TIDE CYCLES ON A DAILY AND MONTHLY BASIS.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING WITH THE CO FOR TEMPORARY PLACEMENT AND STORAGE OF STOCKPILED MATERIALS, EQUIPMENT AND VEHICLES WITHIN THE CONSTRUCTION AREA. THE STAGING AREA SHALL NOT EXCEED THE LIMITS SHOWN WITHIN THESE PLANS, UNLESS APPROVED BY THE PARK MANAGER AND THE CO.
12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING PROPOSED WORK WITH THE CO, PROVIDING ADEQUATE CONTROLS FOR SITE SAFETY, AND MINIMIZING IMPACTS. UNDER NO CIRCUMSTANCES WILL THE CONTRACTOR INITIATE ACTIVITIES THAT WILL RESTRICT ACCESS OF EMERGENCY VEHICLES.
13. ALL PHASING AND SEQUENCING SHALL BE COORDINATED WITH THE CO.

30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO.	TITLE OF SHEET GENERAL NOTES OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 2 OF 58



1100 0 1100 2200

SCALE IN FEET
1" = 1100'

30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO.	TITLE OF SHEET EXISTING CONDITIONS KEY PLAN OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 3 OF 58

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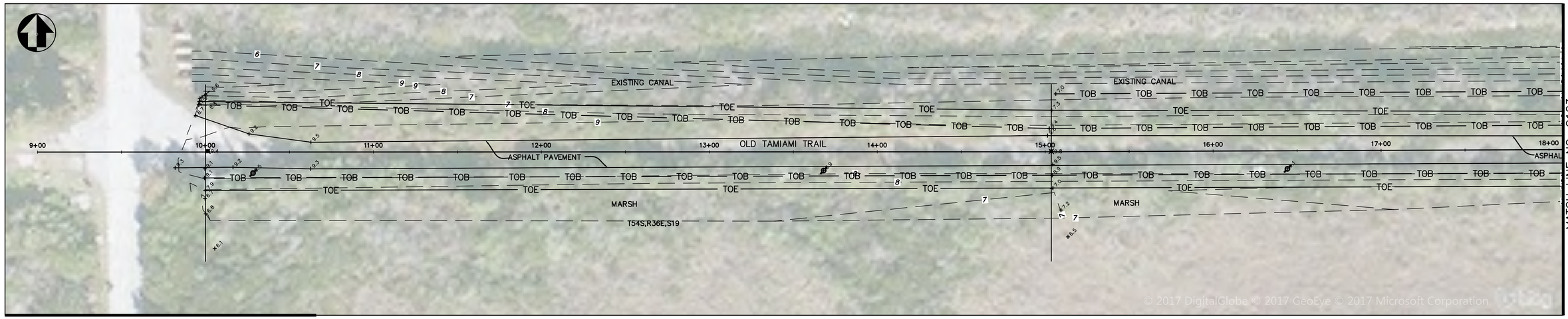

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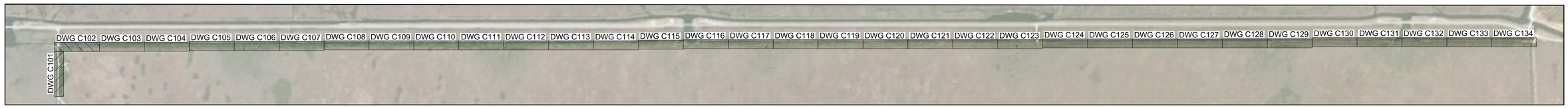
MATCH LINE NO. C101



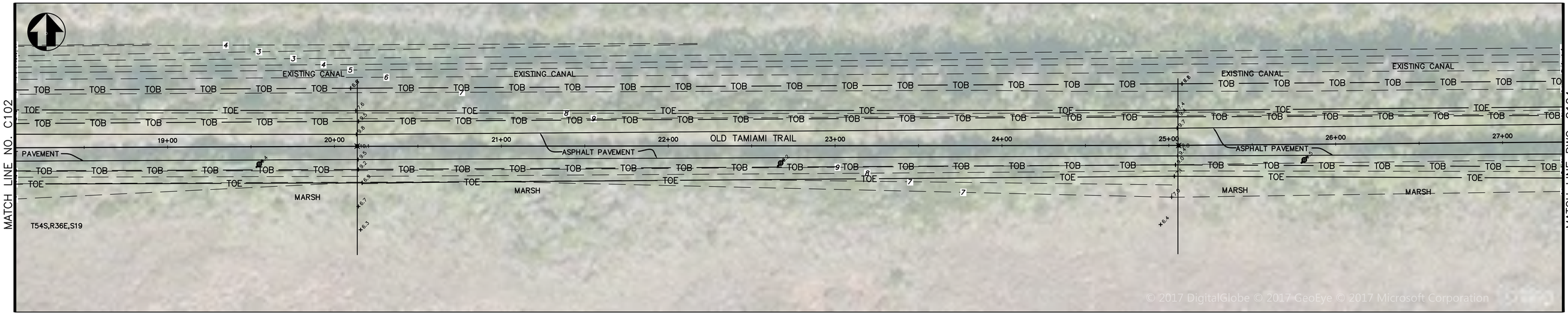
SHEET KEY
NOT TO SCALE

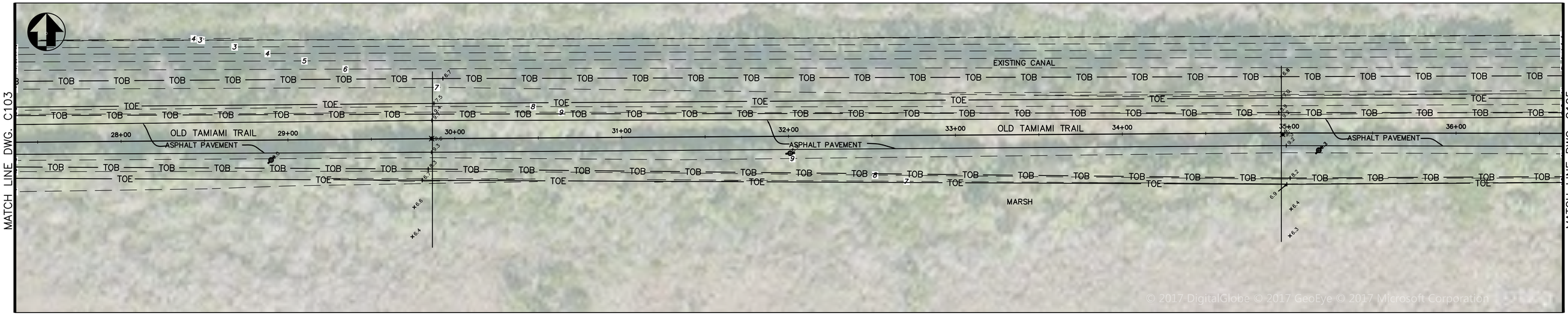
30 0 30 60
SCALE IN FEET
1" = 30'

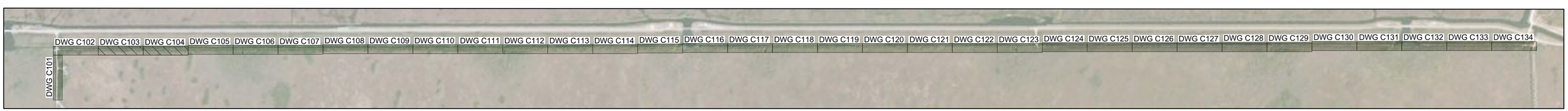
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C101–C102	TITLE OF SHEET EXISTING CONDITIONS – C101–C102 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 4 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







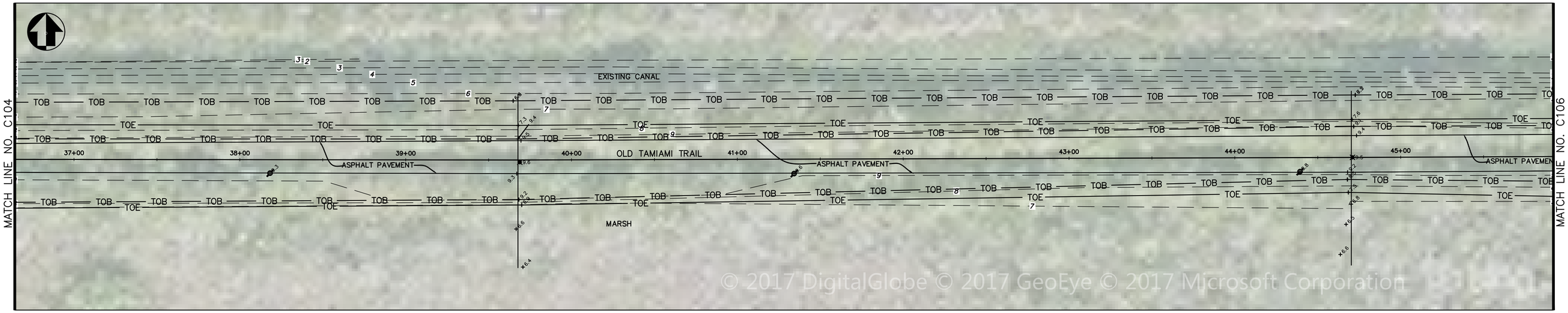
SHEET KEY
NOT TO SCALE

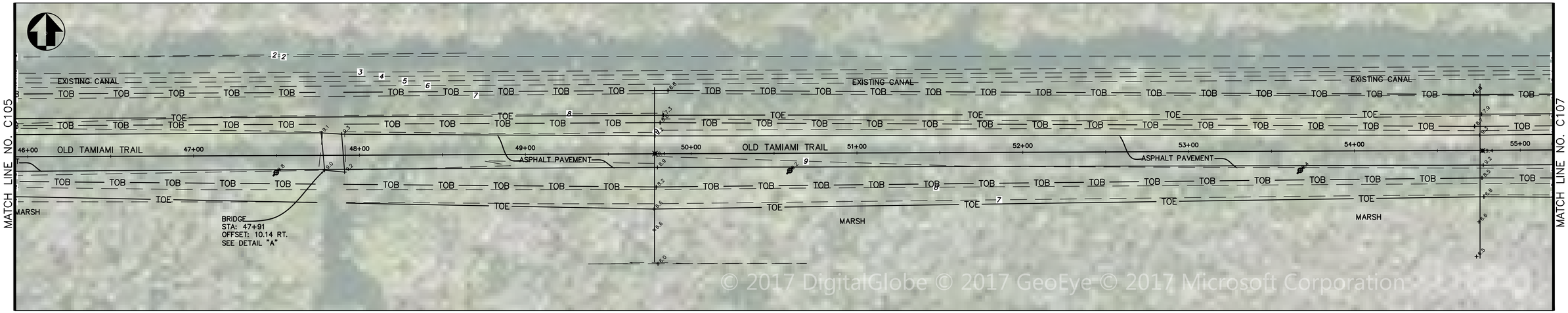
SCALE IN FEET
1" = 30'

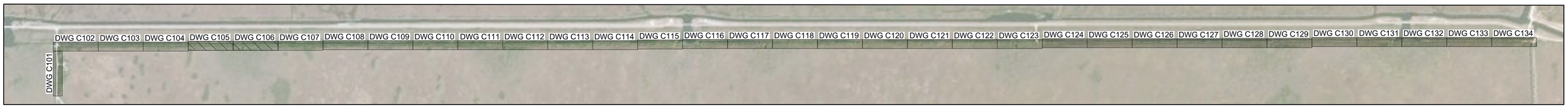
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI DRAWN: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C103–C104	TITLE OF SHEET EXISTING CONDITIONS – C103–C104 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 5 OF 58

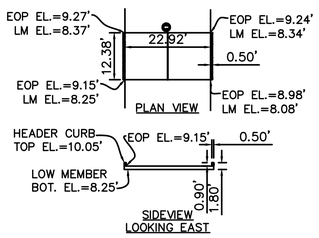
LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







BRIDGE DETAIL "A"
STA: 47+91, OFFSET: 10.14 RT.
NOT TO SCALE

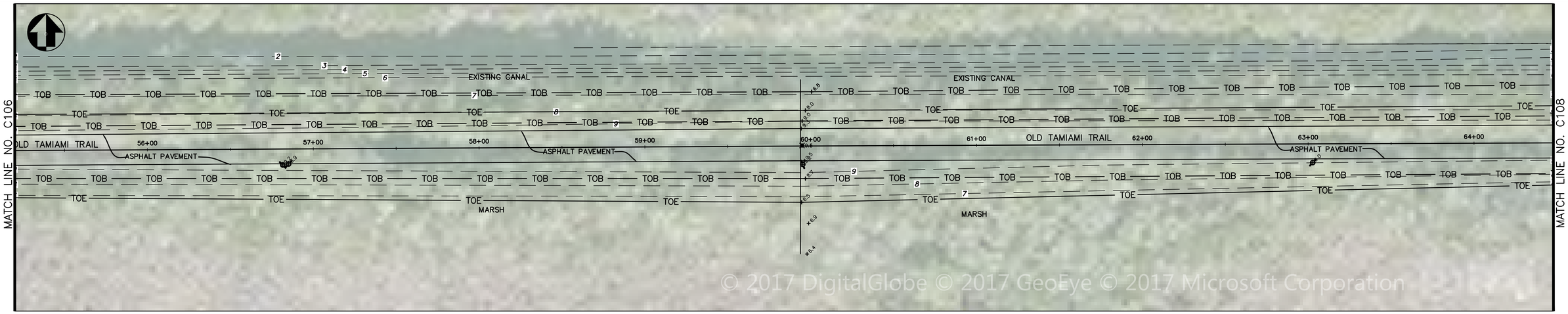


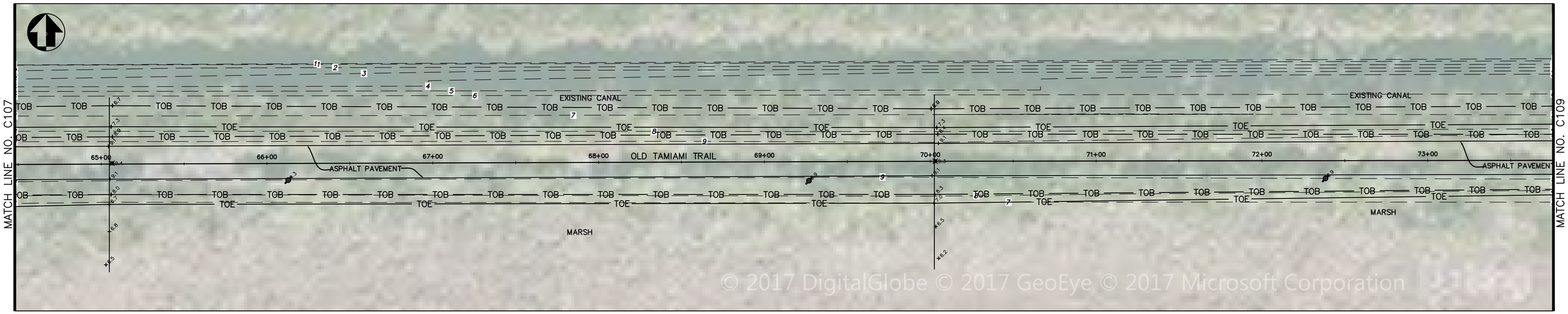
SHEET KEY
NOT TO SCALE

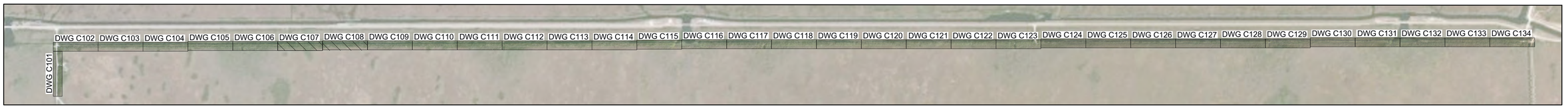
SCALE IN FEET
1" = 30'

30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI	SUB SHEET NO.	TITLE OF SHEET	DRAWING NO.
CADD: AI	C105–C106	EXISTING CONDITIONS – C105–C106 –	EVER 160/ 139363
TECH. REVIEW: BB		OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	PMIS/PKG NO. 233902
DATE: 11/22/17			SHEET 6 OF 58







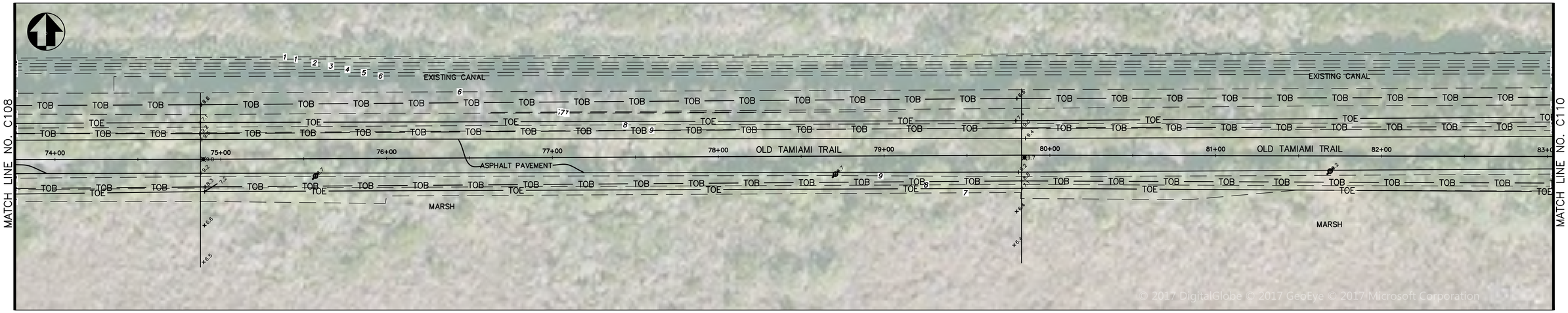
SHEET KEY
NOT TO SCALE

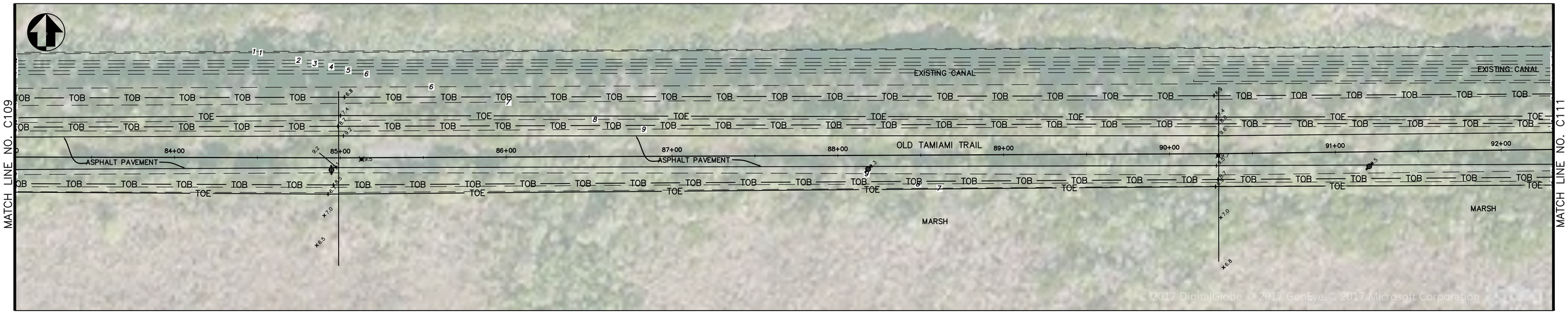
30 0 30 60
SCALE IN FEET
1" = 30'

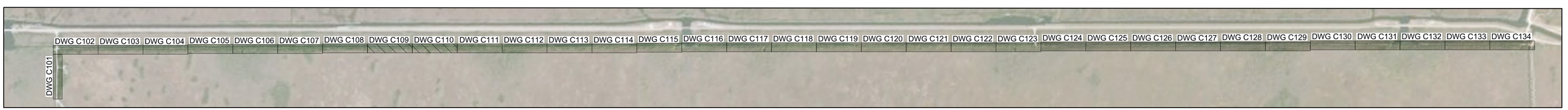
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C107–C108	TITLE OF SHEET EXISTING CONDITIONS – C107–C108 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 7 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







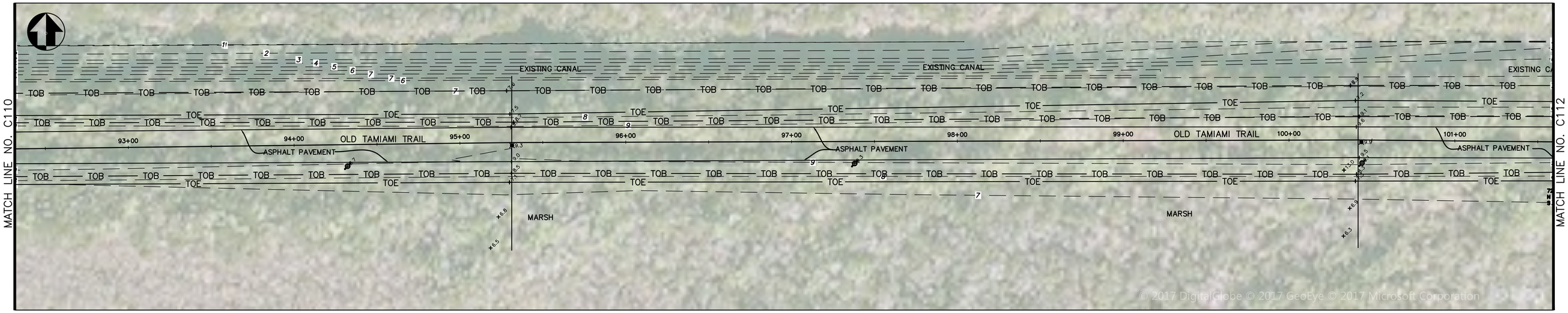
SHEET KEY
NOT TO SCALE

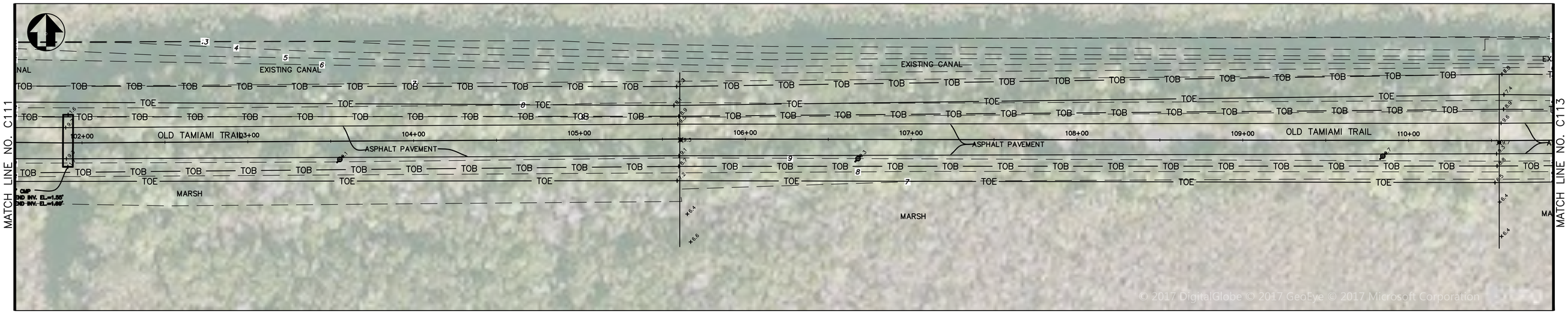
30 0 30 60
SCALE IN FEET
1" = 30'

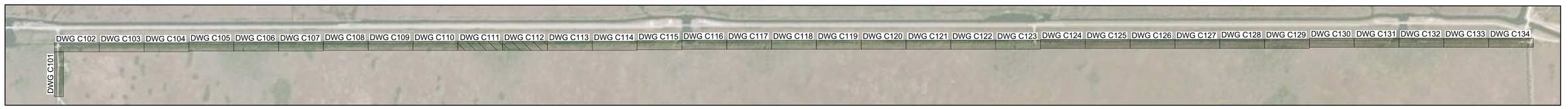
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C109–C110	TITLE OF SHEET EXISTING CONDITIONS – C109–C110 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 8 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







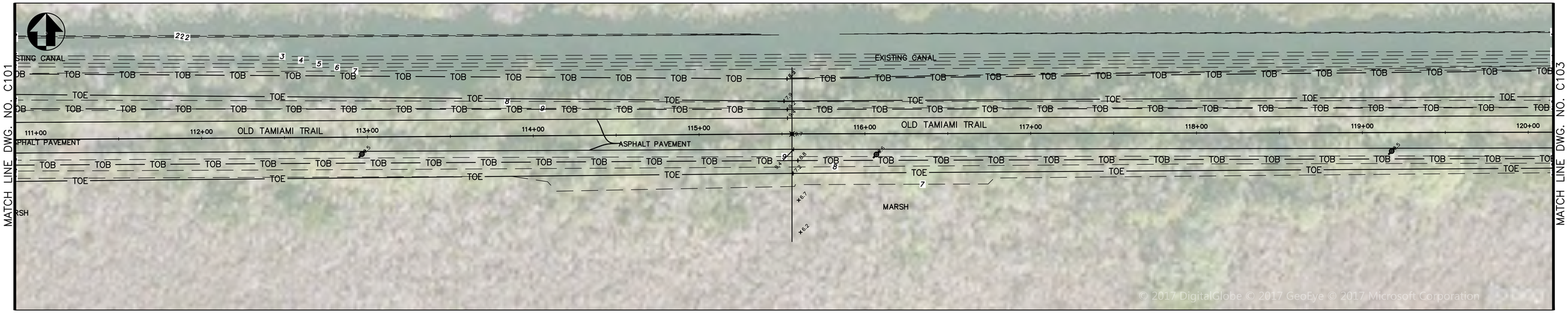
SHEET KEY
NOT TO SCALE

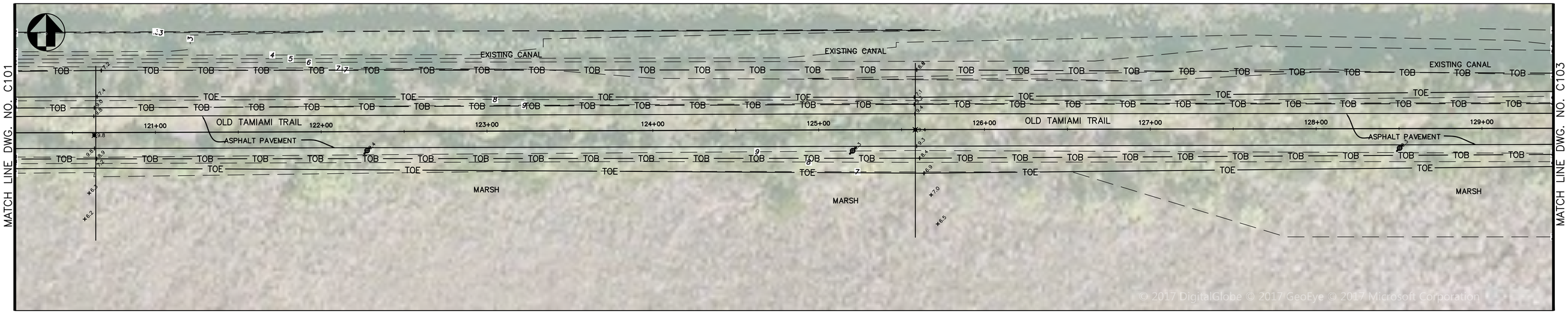
30 0 30 60
SCALE IN FEET
1" = 30'

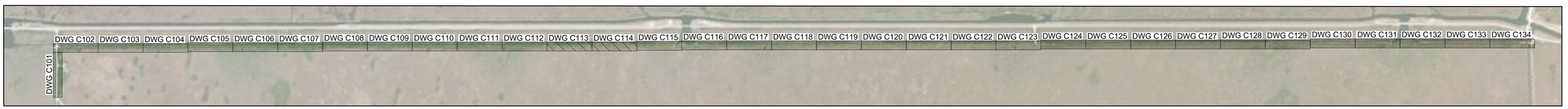
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C111–C112	TITLE OF SHEET EXISTING CONDITIONS – C111–C112 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 9 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







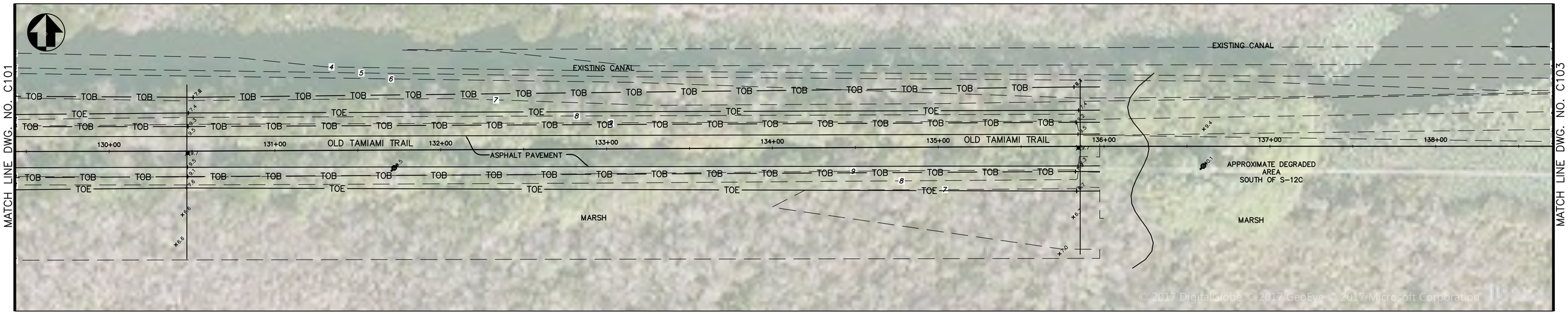
SHEET KEY
NOT TO SCALE

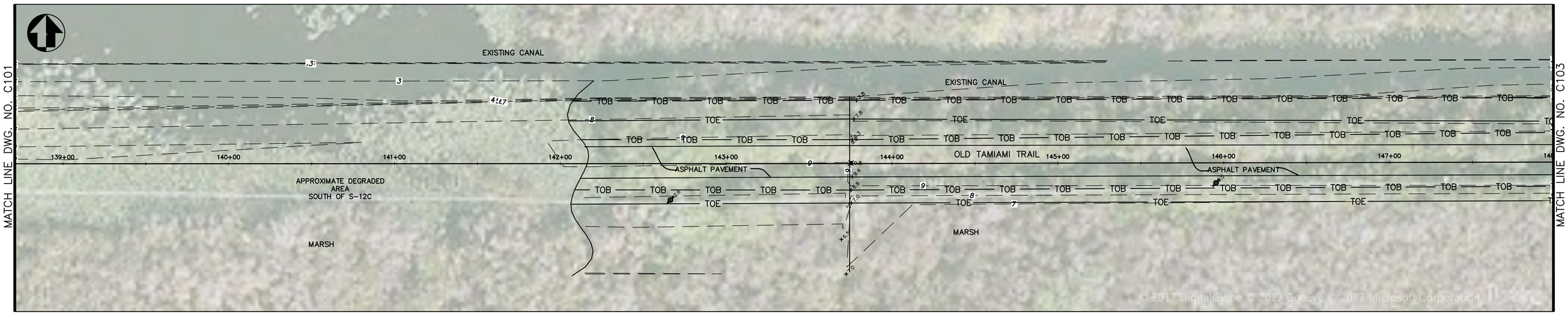
30 0 30 60
SCALE IN FEET
1" = 30'

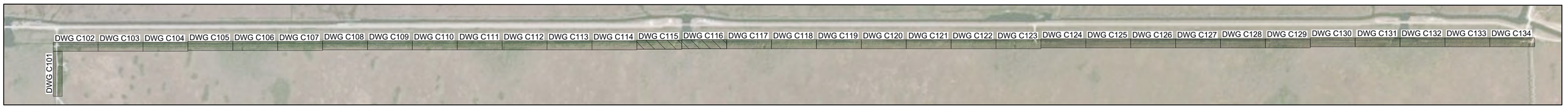
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C113–C114	TITLE OF SHEET EXISTING CONDITIONS – C113–C114 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 10 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







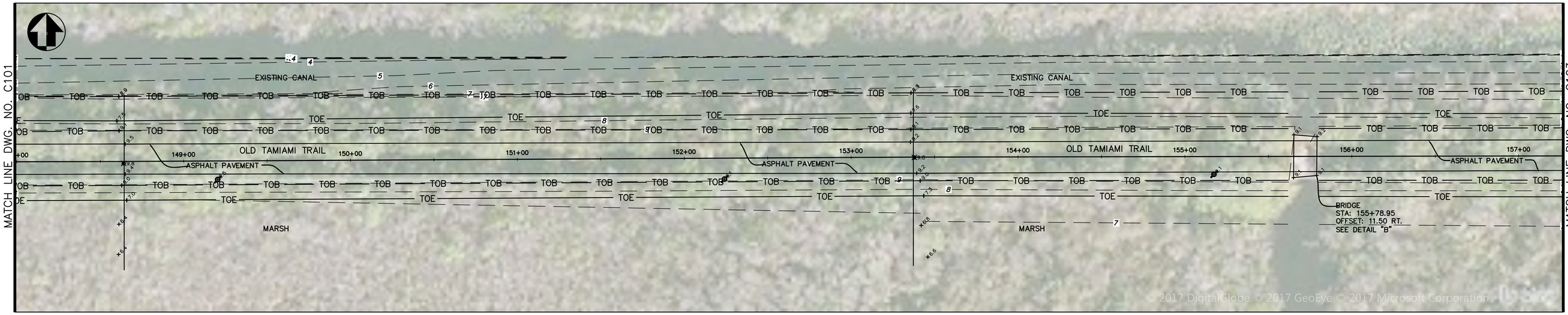
SHEET KEY
NOT TO SCALE

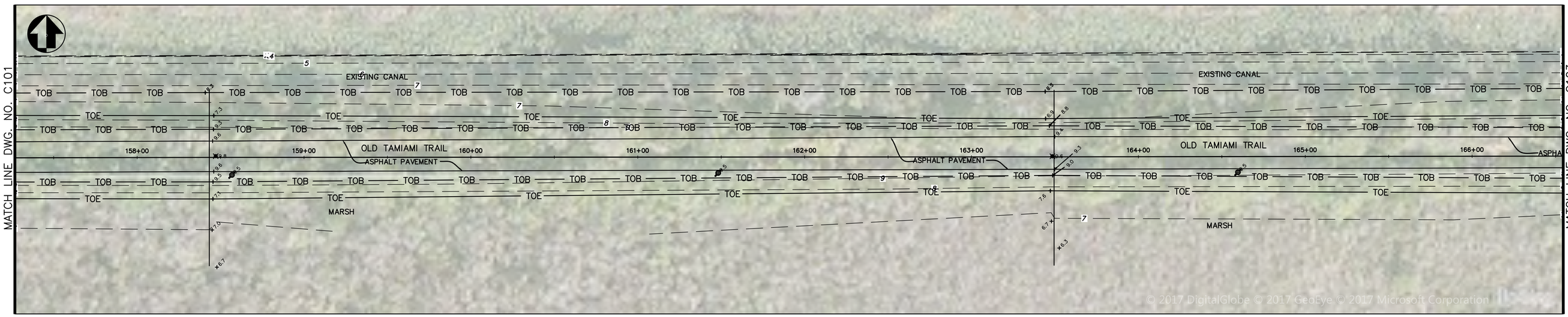
30 0 30 60
SCALE IN FEET
1" = 30'

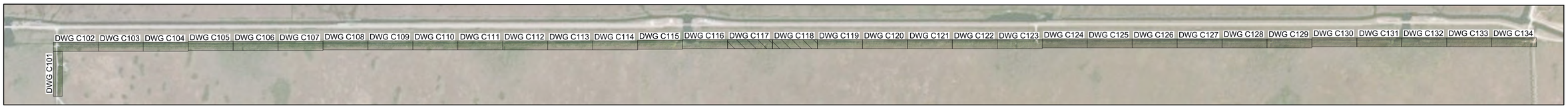
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI DRAWN: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C115–C116	TITLE OF SHEET EXISTING CONDITIONS – C115–C116 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 11 OF 58

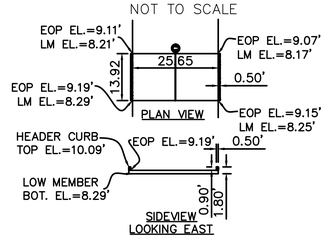
LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Jnggns\Everglades Old Tamiami\Drawings Revision_1 - Copy\Plot\EXISTING.dwg Nov 22, 2017







BRIDGE DETAIL "B"
STA: 155+78.95, OFFSET: 11.50 RT.
NOT TO SCALE



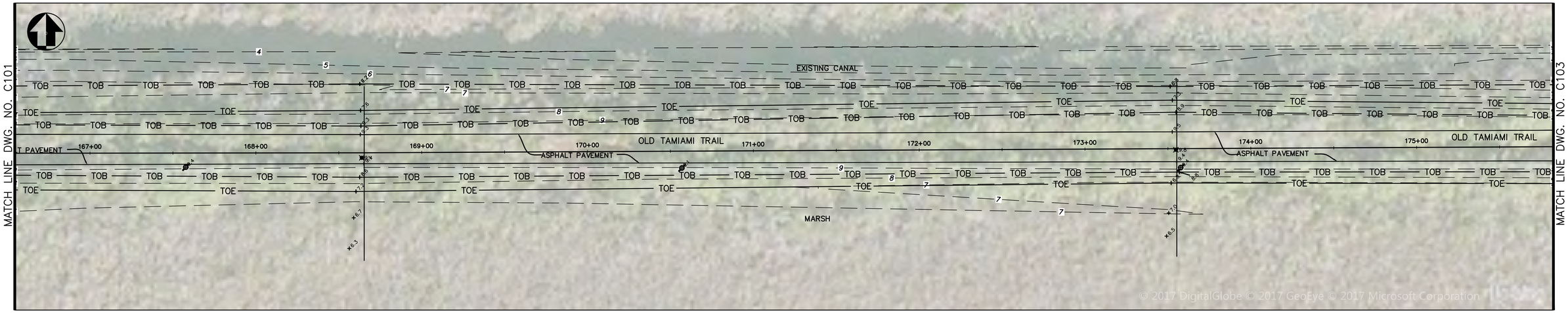
SHEET KEY
NOT TO SCALE

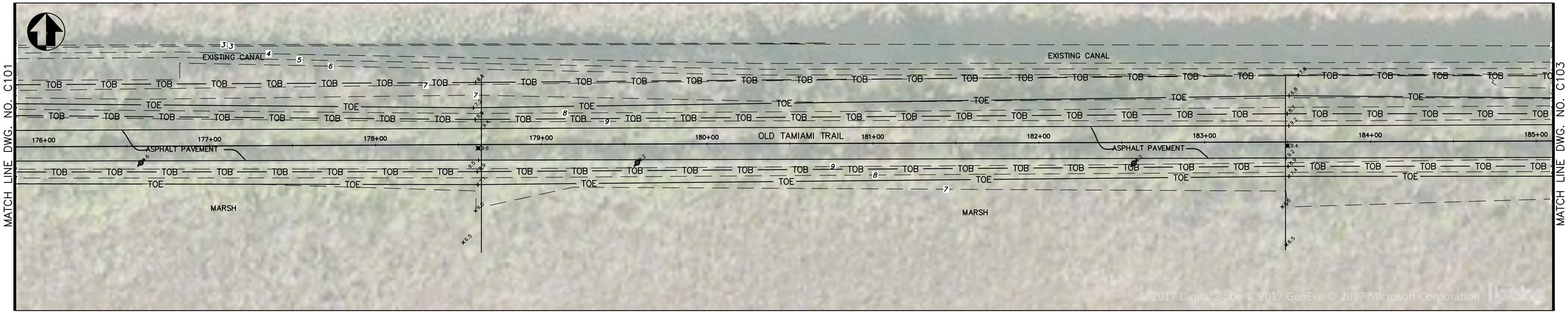
SCALE IN FEET
1" = 30'

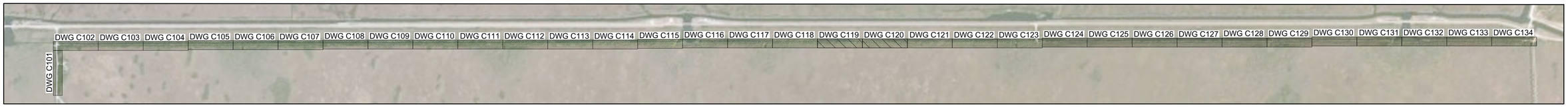
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI DRAWN: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C117–C118	TITLE OF SHEET EXISTING CONDITIONS – C117–C118 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 12 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







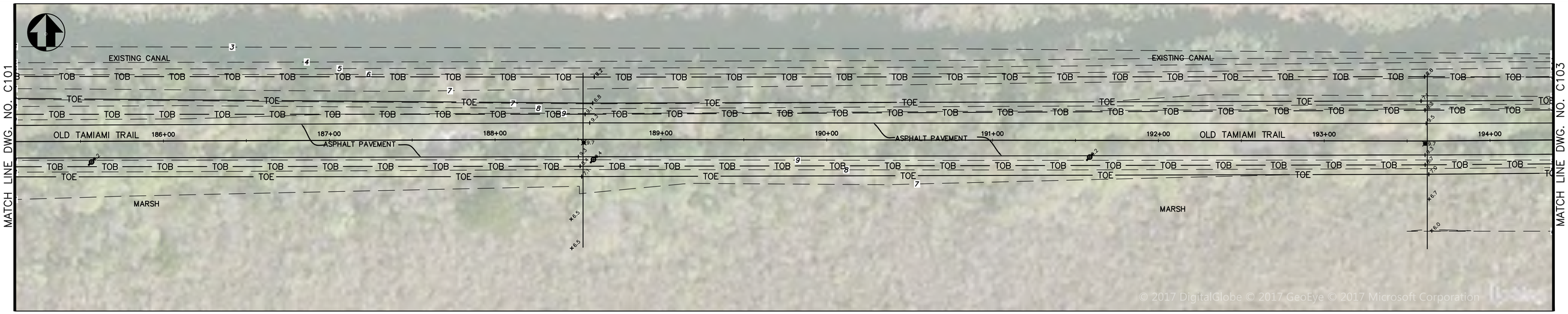
SHEET KEY
NOT TO SCALE

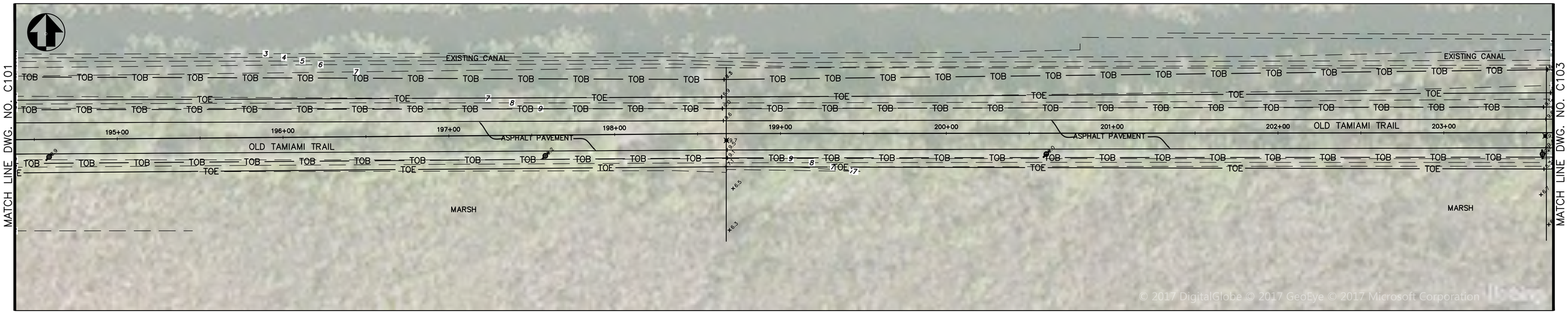
30 0 30 60
SCALE IN FEET
1" = 30'

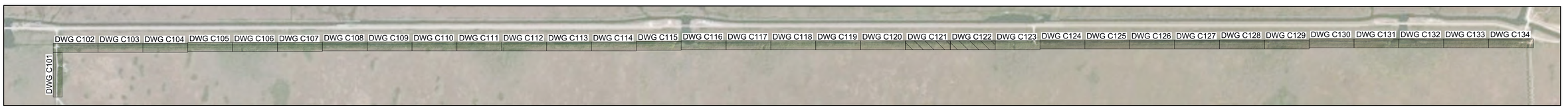
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C119–C120	TITLE OF SHEET EXISTING CONDITIONS – C119–C120 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 13 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







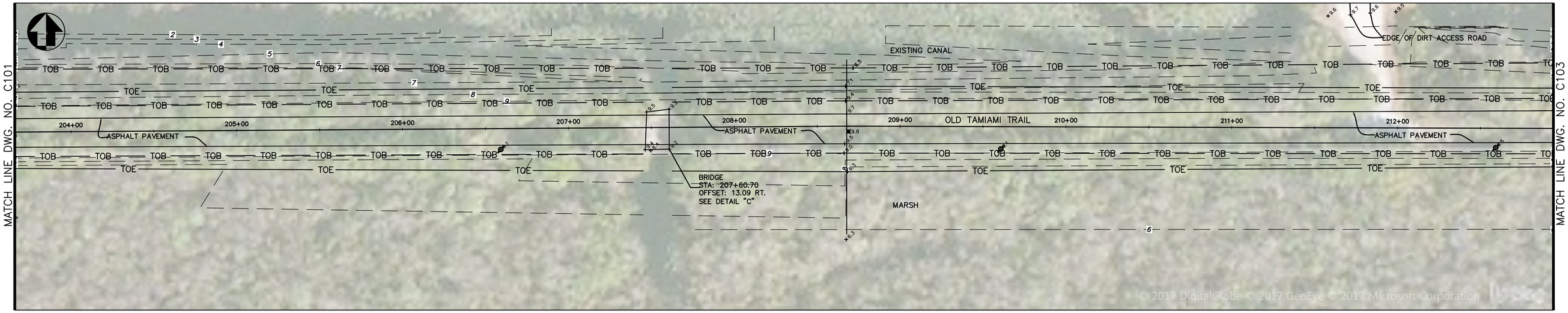
SHEET KEY
NOT TO SCALE

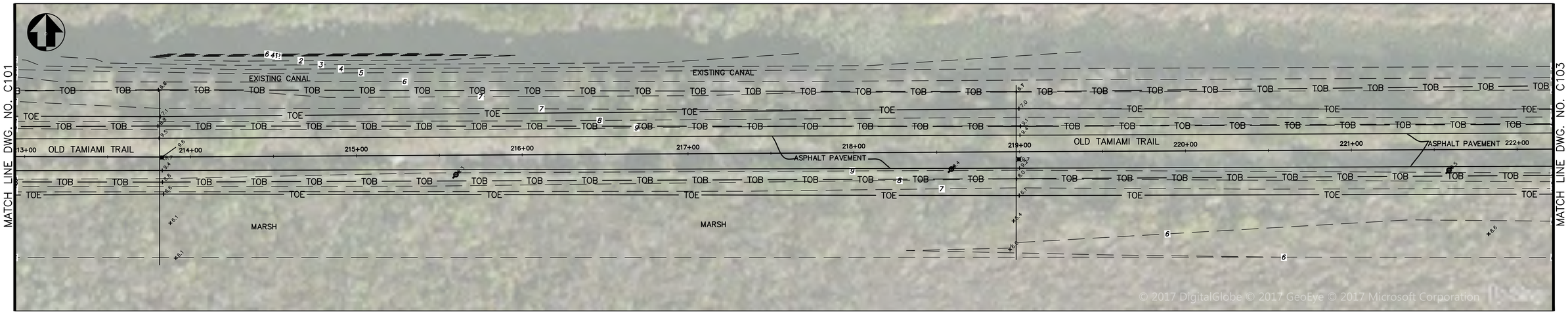
30 0 30 60
SCALE IN FEET
1" = 30'

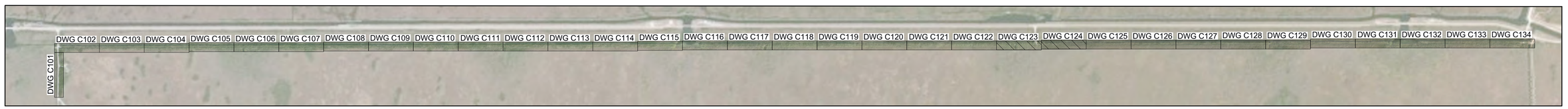
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C121–C122	TITLE OF SHEET EXISTING CONDITIONS – C121–C122 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 14 OF 58

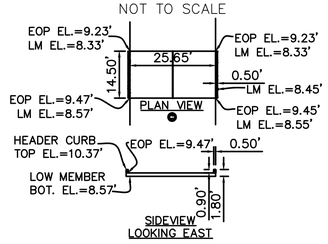
LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alngans\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







BRIDGE DETAIL "C"
STA: 207+60.70, OFFSET: 13.09 RT.
NOT TO SCALE



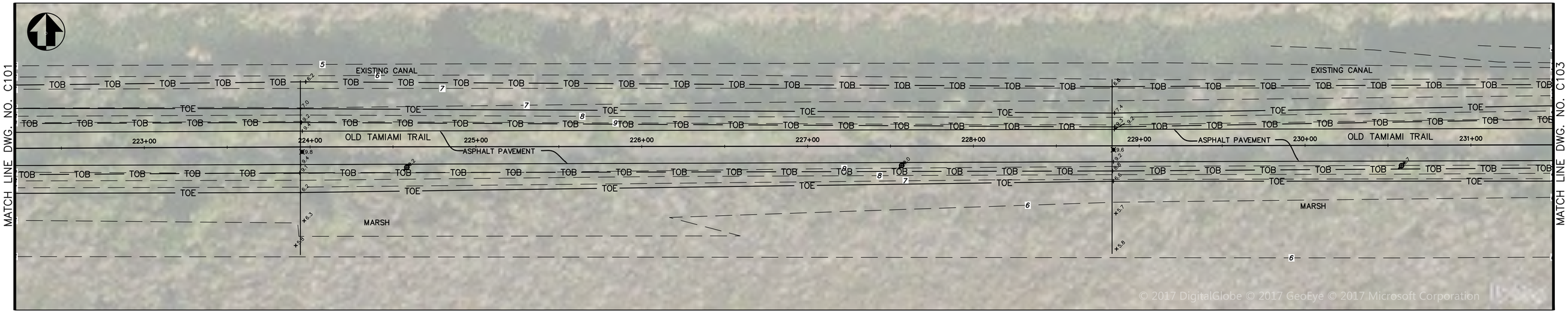
SHEET KEY
NOT TO SCALE

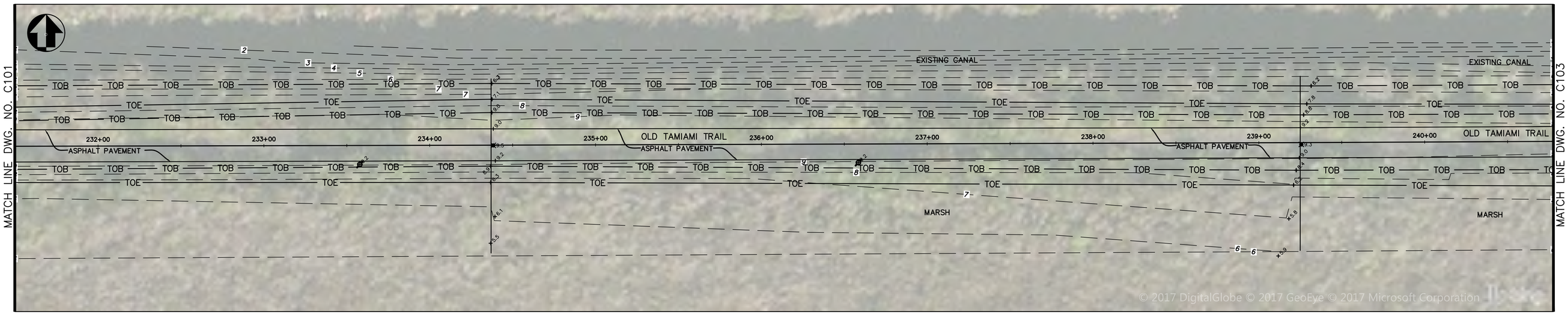
SCALE IN FEET
1" = 30'

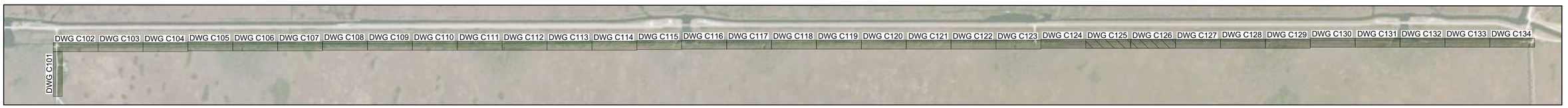
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C123–C124	TITLE OF SHEET EXISTING CONDITIONS – C123–C124 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 15 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







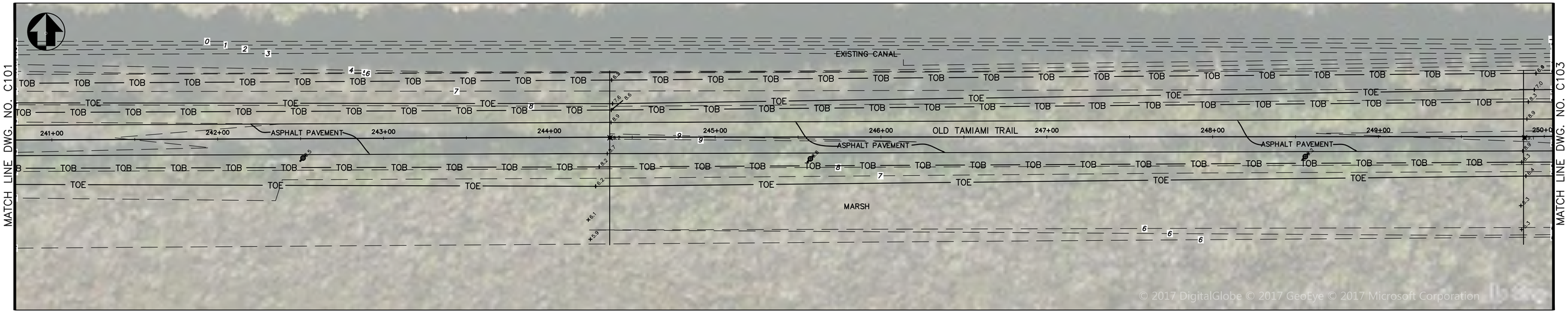
SHEET KEY
NOT TO SCALE

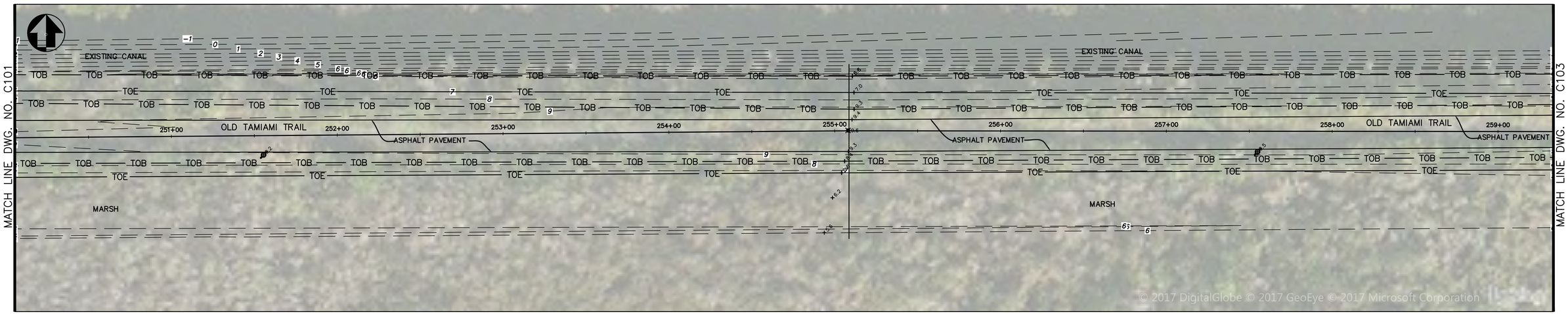
30 0 30 60
SCALE IN FEET
1" = 30'

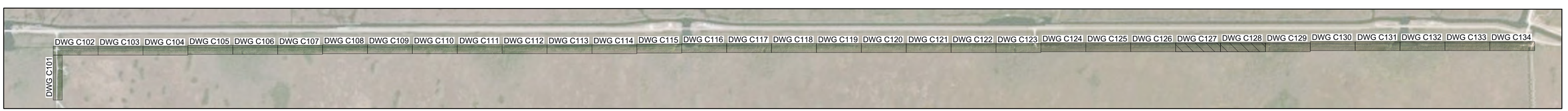
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C125–C126	TITLE OF SHEET EXISTING CONDITIONS – C125–C126 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 16 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Anggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







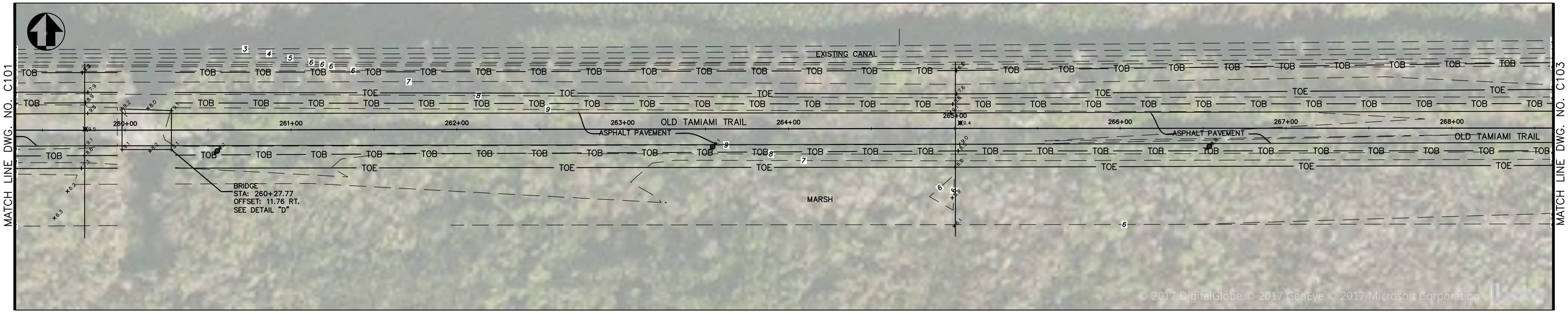
SHEET KEY
NOT TO SCALE

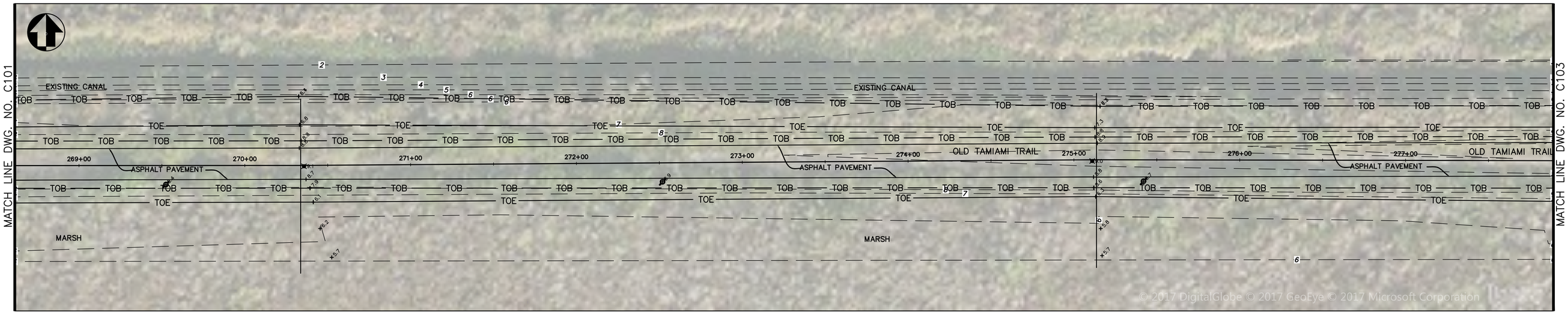
30 0 30 60
SCALE IN FEET
1" = 30'

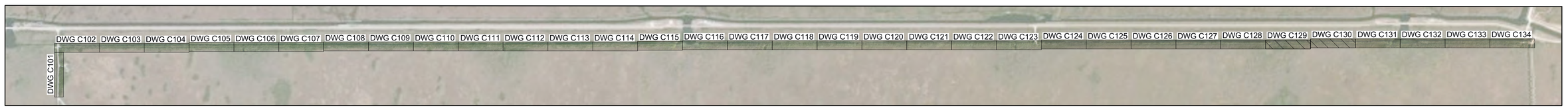
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C127–C128	TITLE OF SHEET EXISTING CONDITIONS – C127–C128 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 17 OF 58

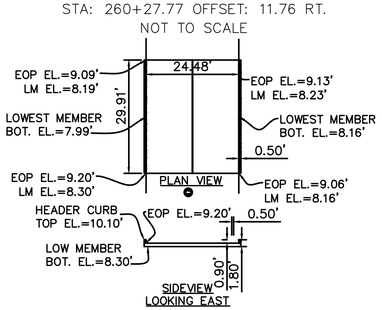
LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







BRIDGE DETAIL "D"
STA: 260+27.77 OFFSET: 11.76 RT.
NOT TO SCALE



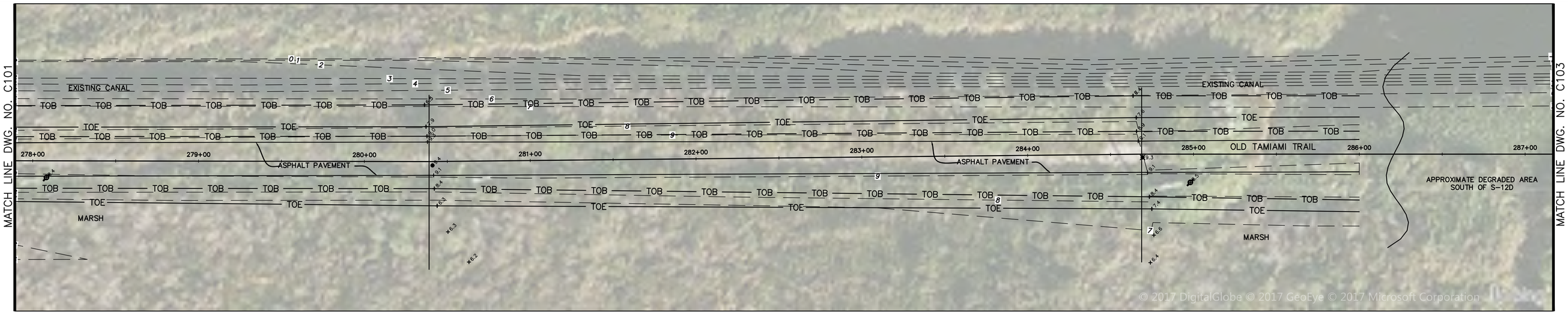
SHEET KEY
NOT TO SCALE

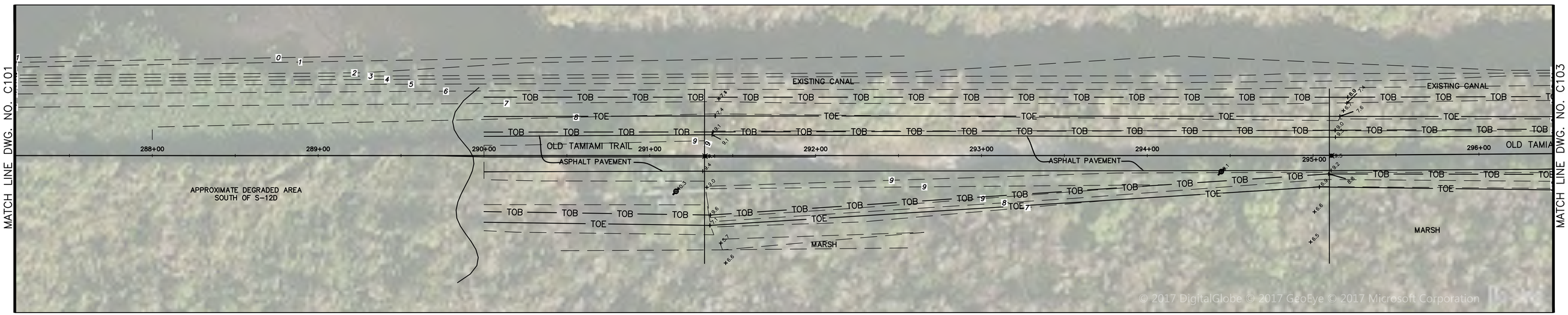
SCALE IN FEET
1"= 30'

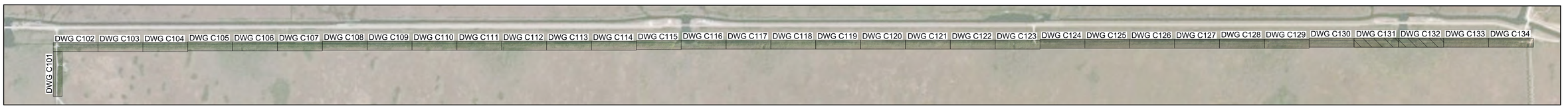
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C129–C130	TITLE OF SHEET EXISTING CONDITIONS – C129–C130 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 18 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







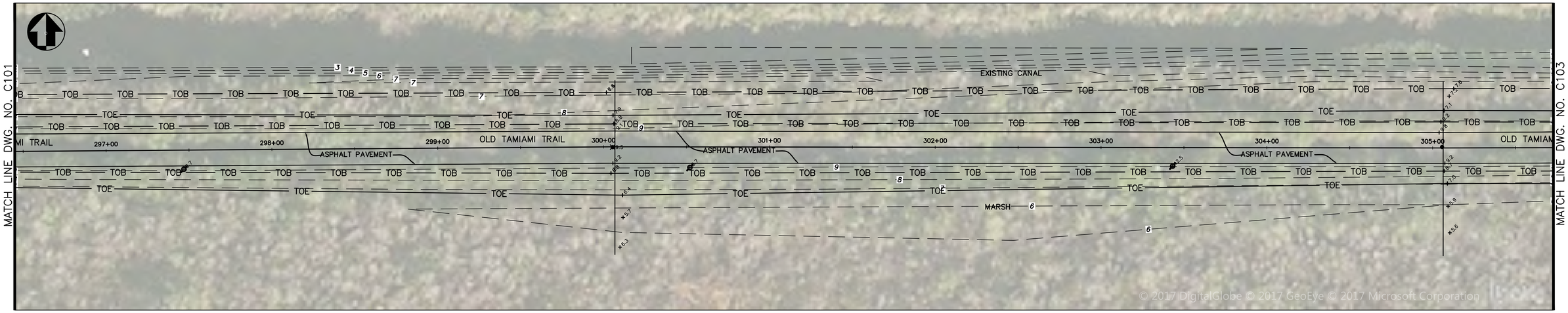
SHEET KEY
NOT TO SCALE

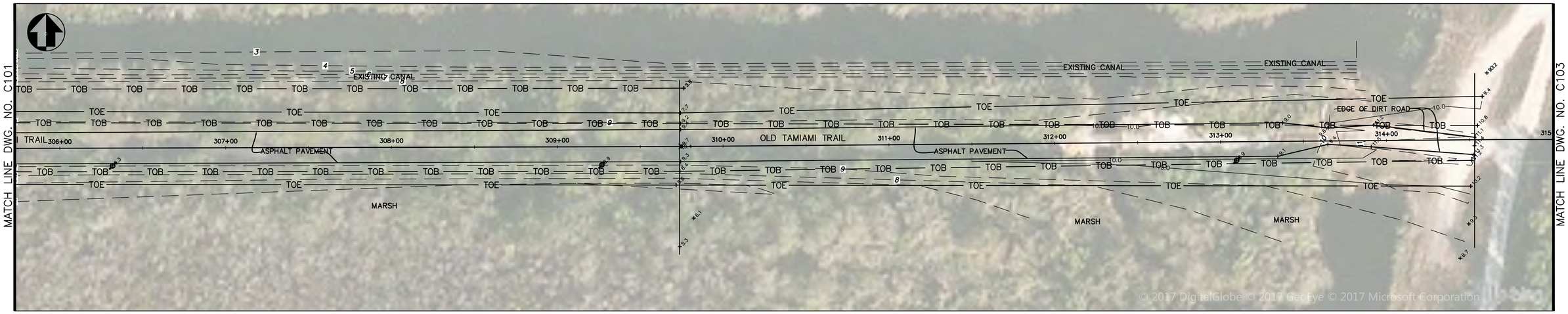
30 0 30 60
SCALE IN FEET
1" = 30'

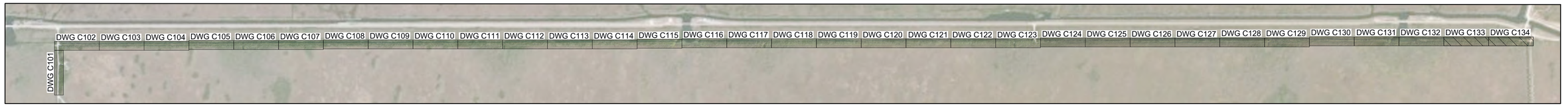
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO.	TITLE OF SHEET EXISTING CONDITIONS – C131–C132 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 19 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017







SHEET KEY
NOT TO SCALE

30 0 30 60
SCALE IN FEET
1" = 30'

30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C133–C134	TITLE OF SHEET EXISTING CONDITIONS – C133–C134 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 20 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\EXISTING.dwg Nov 22, 2017

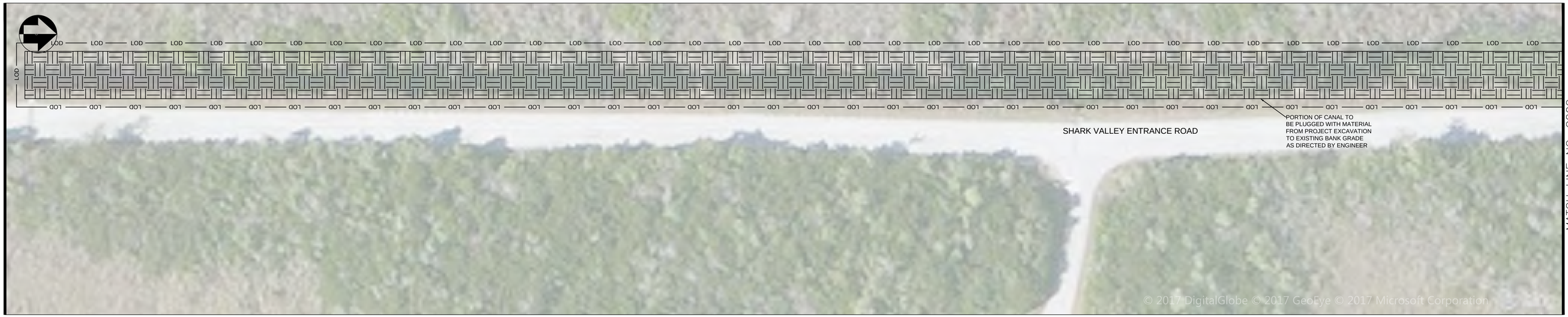
1100 0 1100 2200

SCALE IN FEET
1" = 1100'

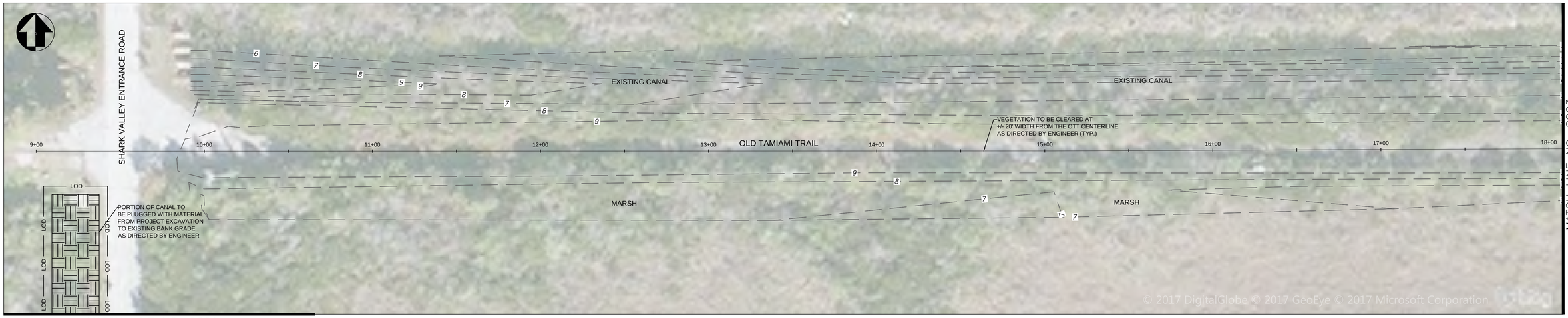
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO.	TITLE OF SHEET ALTERNATIVE 1 KEY PLAN OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 21 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 - Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017



MATCH LINE NO. C202



MATCH LINE NO. C203

MATCH LINE NO. C201

SHEET KEY

NOT TO SCALE

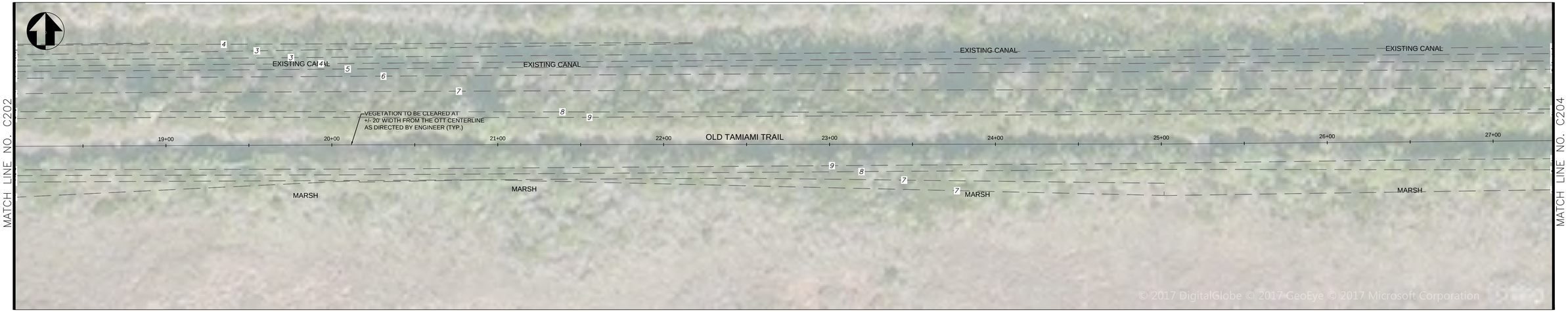
30 0 30 60

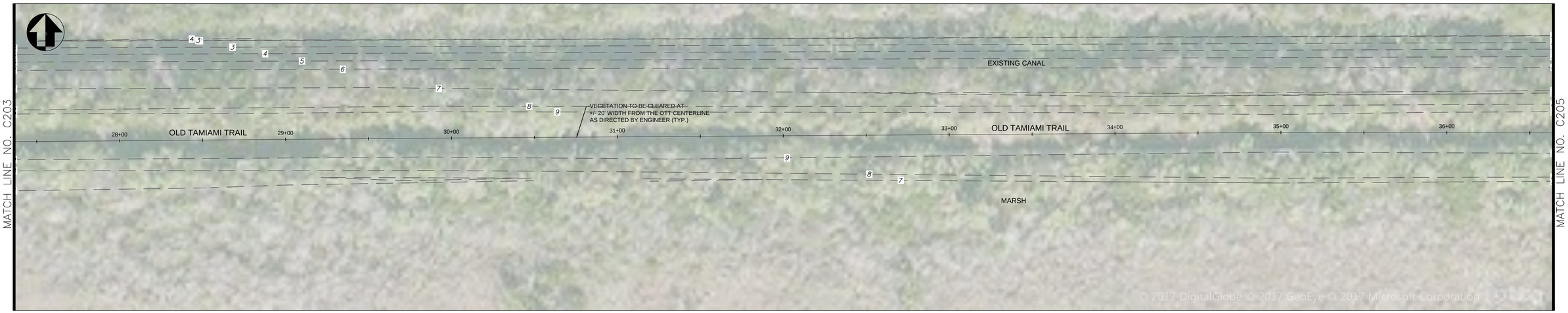
SCALE IN FEET
1" = 30'

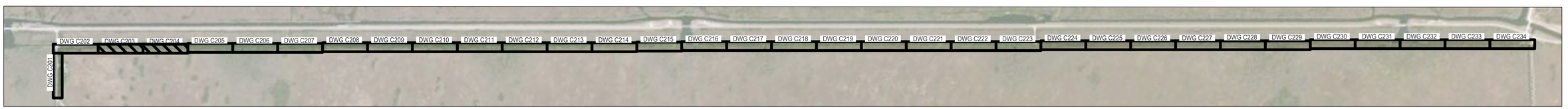
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C201–C202	TITLE OF SHEET ALTERNATIVE 1 – C201–C202 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 22 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017







SHEET KEY

NOT TO SCALE

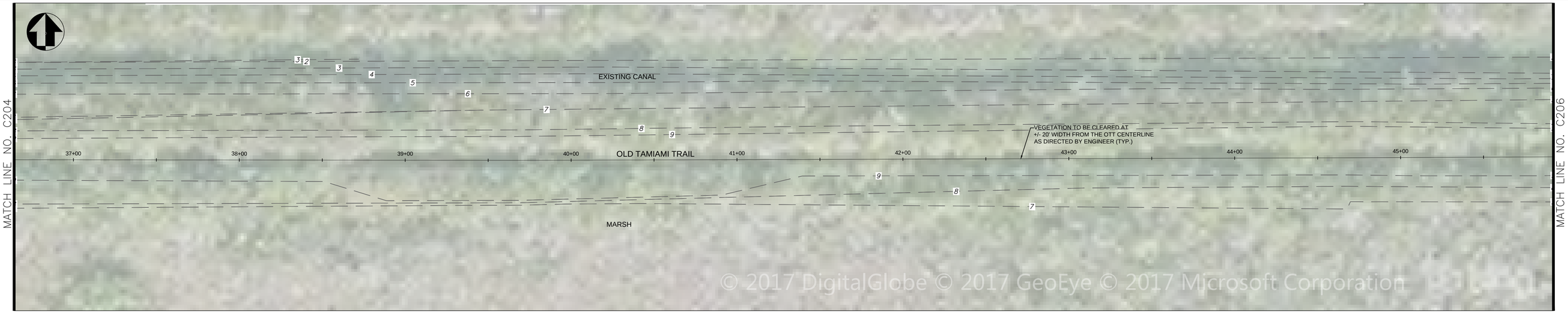
30 0 30 60

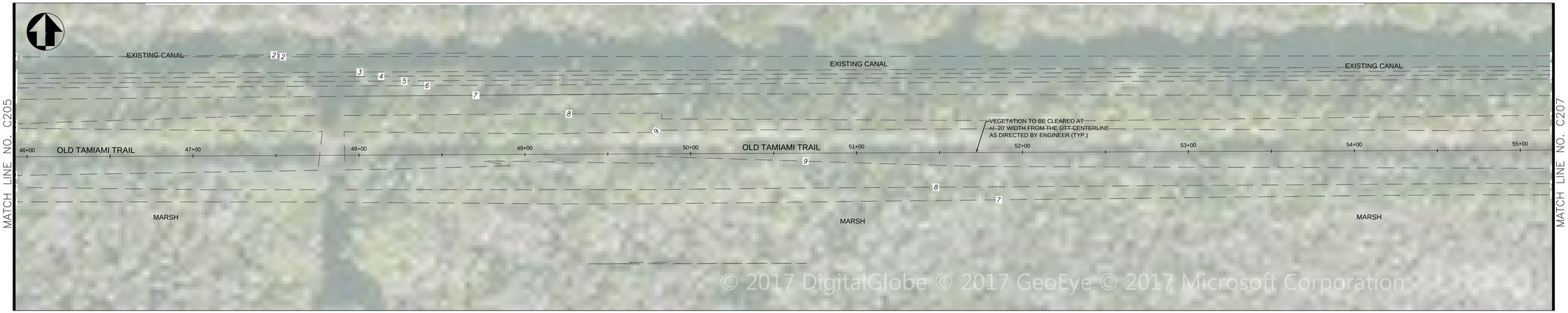
SCALE IN FEET
1" = 30'

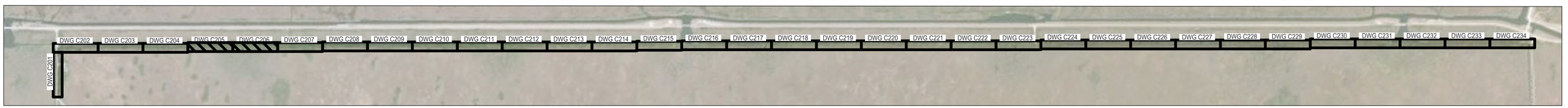
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C203–C204	TITLE OF SHEET ALTERNATIVE 1 – C203–C204 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 23 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017







SHEET KEY

NOT TO SCALE

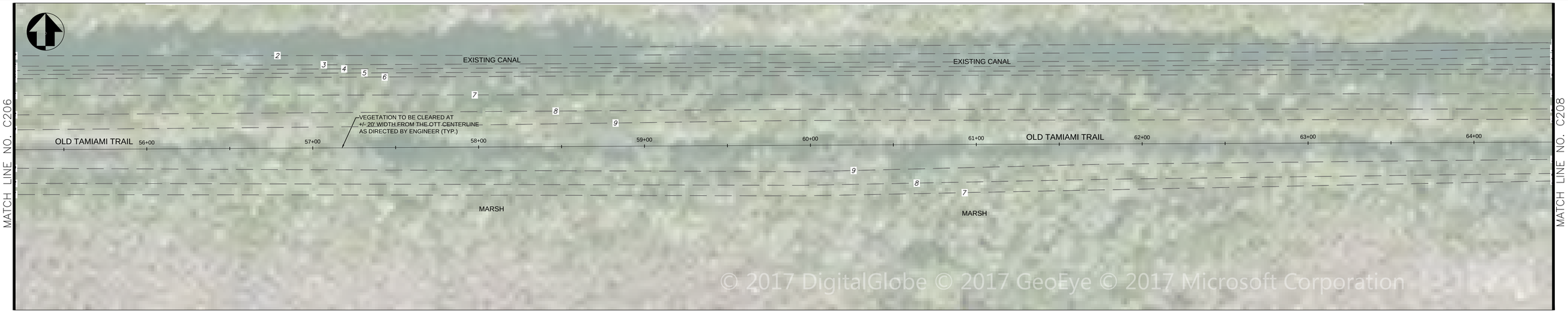
30 0 30 60

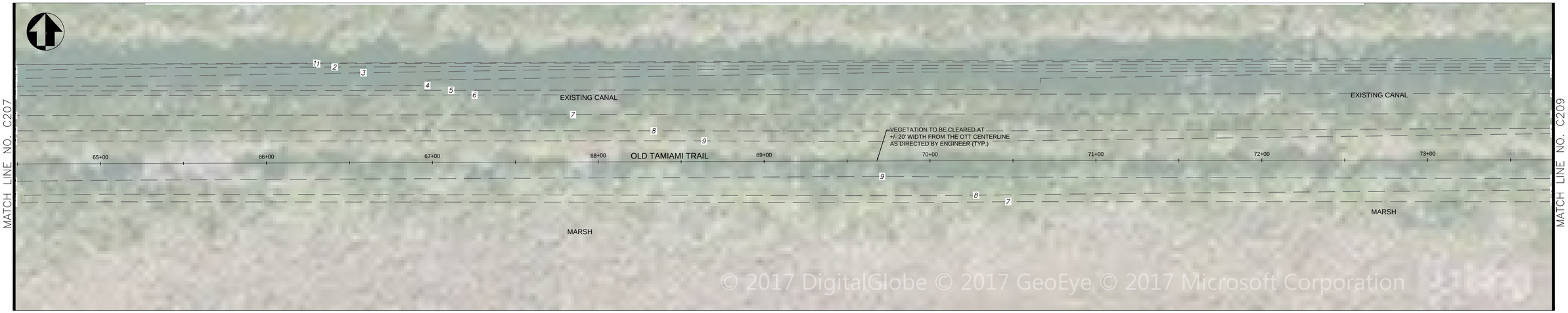
SCALE IN FEET
1" = 30'

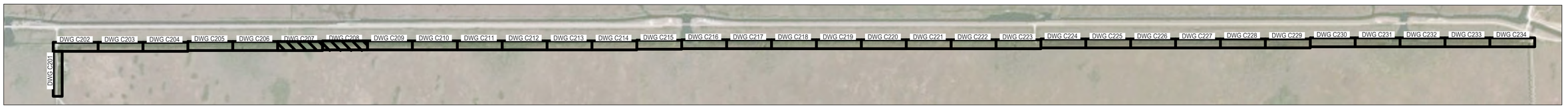
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C205–C206	TITLE OF SHEET ALTERNATIVE 1 – C205–C206 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 24 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 - Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017







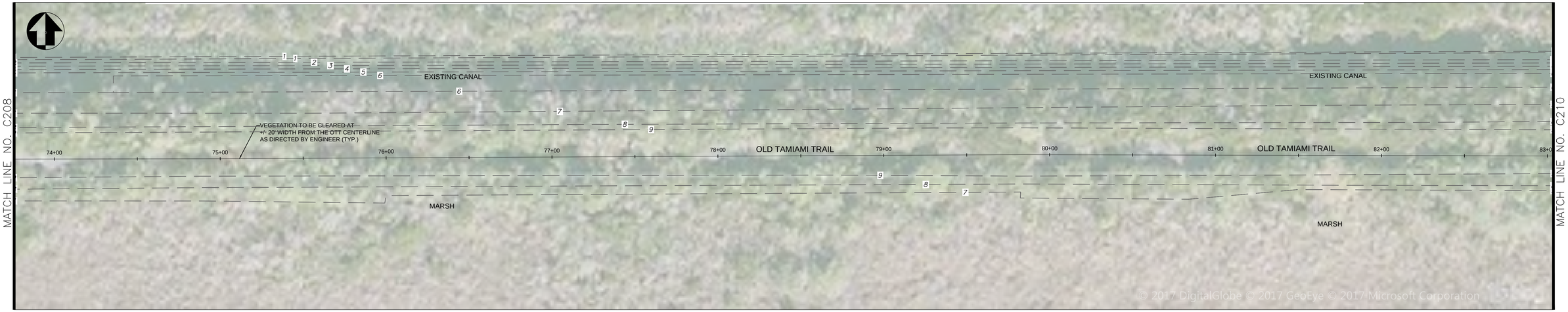
SHEET KEY
NOT TO SCALE

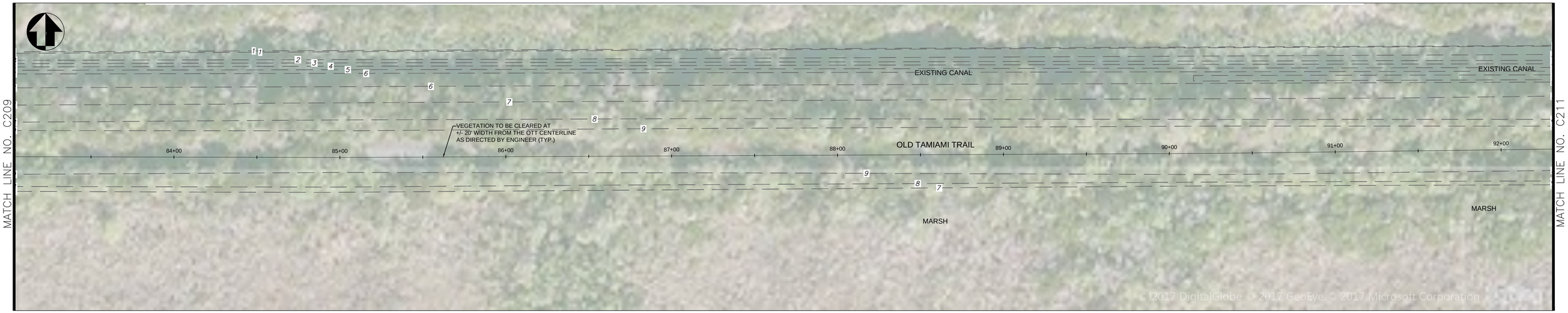
30 0 30 60
SCALE IN FEET
1" = 30'

30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C207–C208	TITLE OF SHEET ALTERNATIVE 1– C207–C208 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 25 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Angns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017





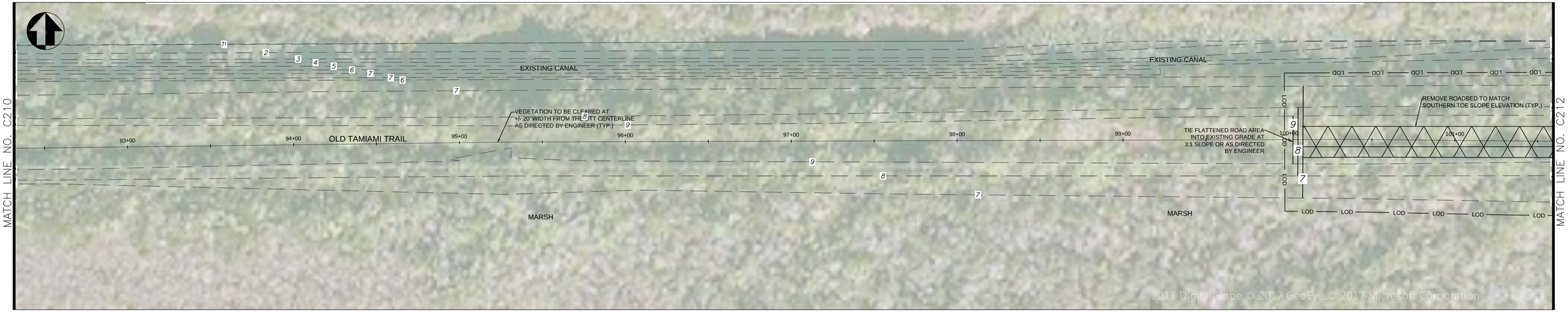
SHEET KEY
NOT TO SCALE

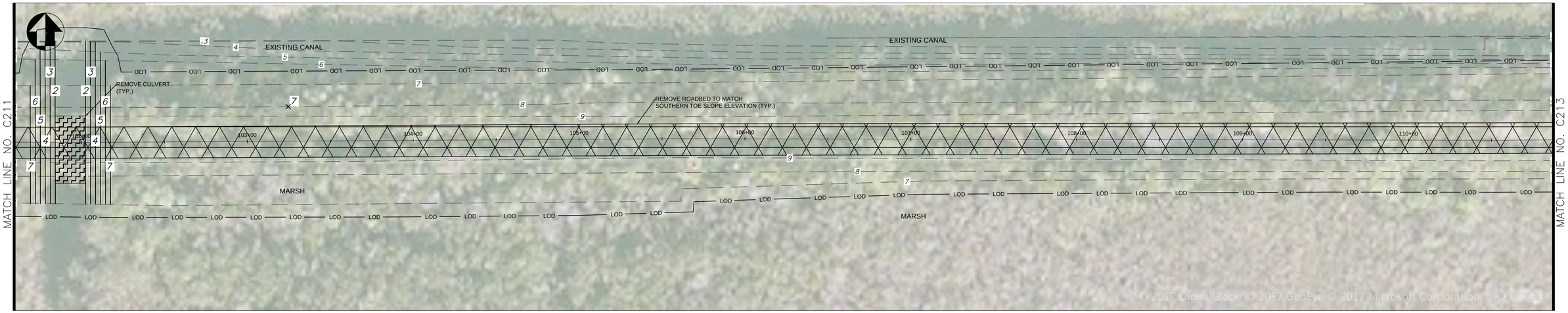
30 0 30 60
SCALE IN FEET
1" = 30'

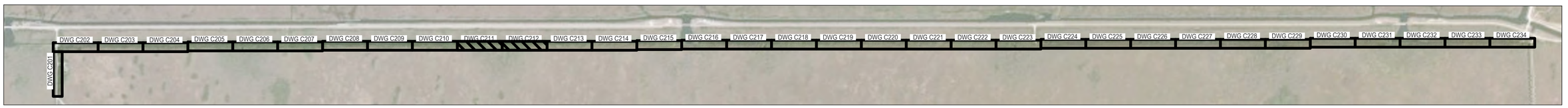
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI DRAWN: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C209–C210	TITLE OF SHEET ALTERNATIVE 1 – C209–C210 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 26 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017







SHEET KEY

NOT TO SCALE

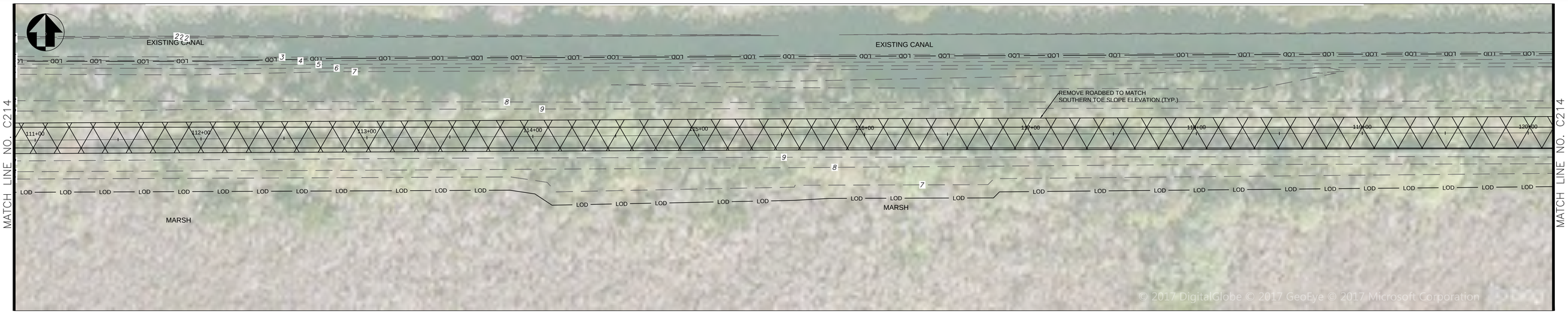
30 0 30 60

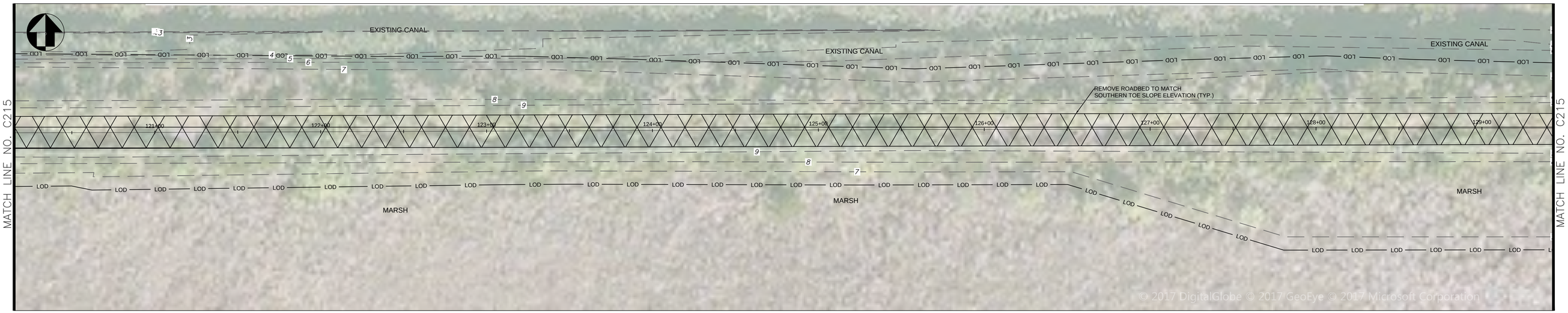
SCALE IN FEET
1" = 30'

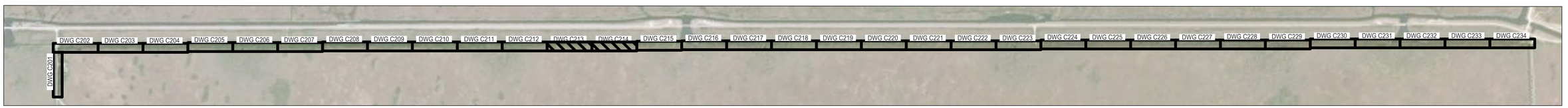
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C211–C212	TITLE OF SHEET ALTERNATIVE 1 – C211–C212 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 27 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alngns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017







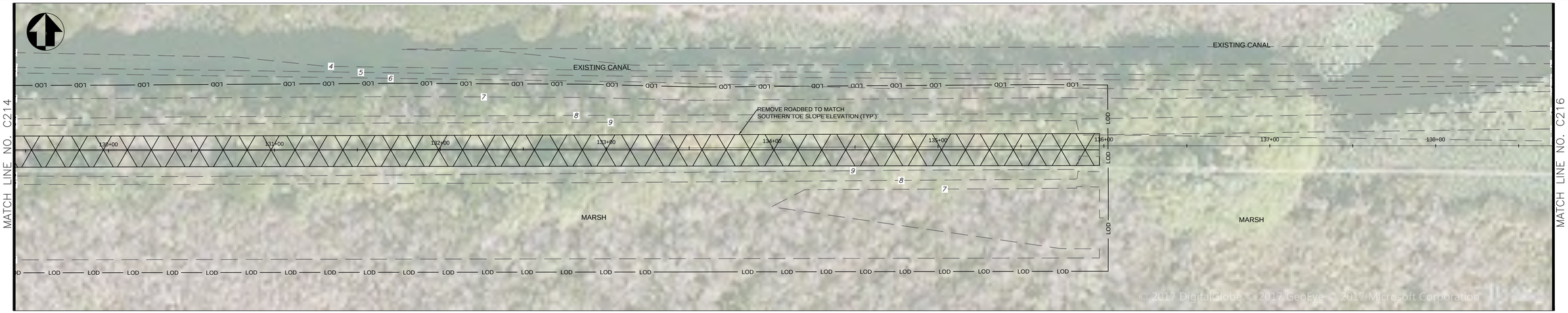
SHEET KEY
NOT TO SCALE

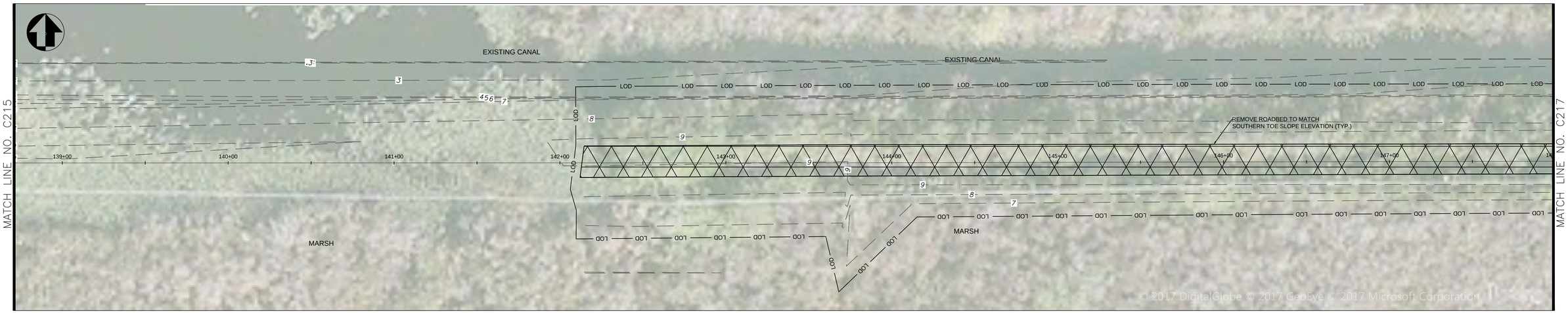
30 0 30 60
SCALE IN FEET
1" = 30'

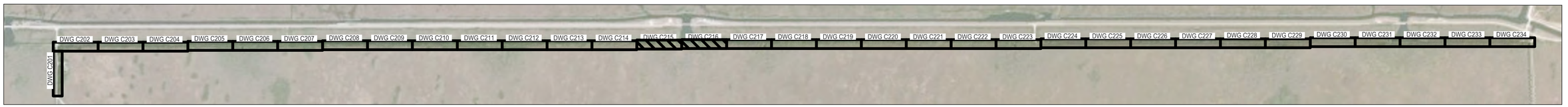
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C213–C214	TITLE OF SHEET ALTERNATIVE 1 – C213–C214 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 28 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Anggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017







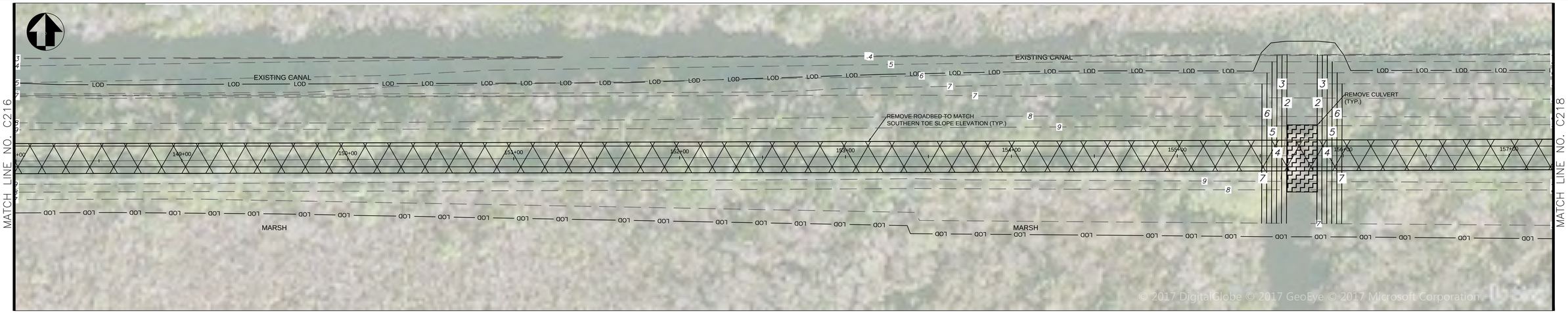
SHEET KEY
NOT TO SCALE

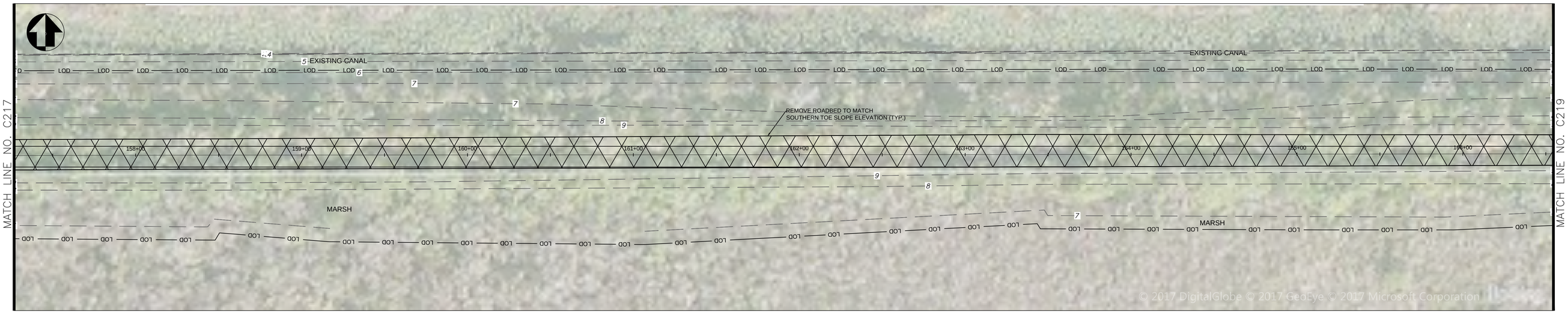
30 0 30 60
SCALE IN FEET
1" = 30'

30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C215–C216	TITLE OF SHEET ALTERNATIVE 1 – C215–C216 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 29 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017





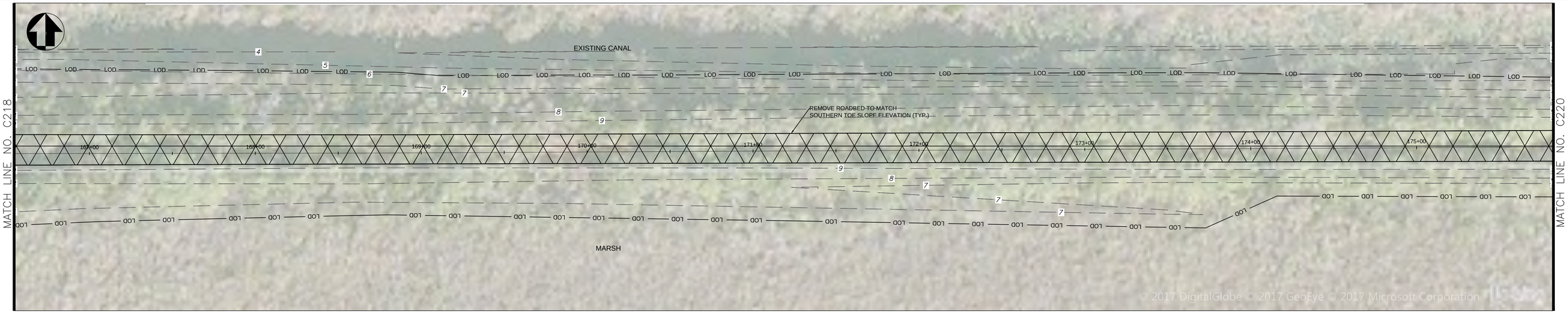
SHEET KEY
NOT TO SCALE

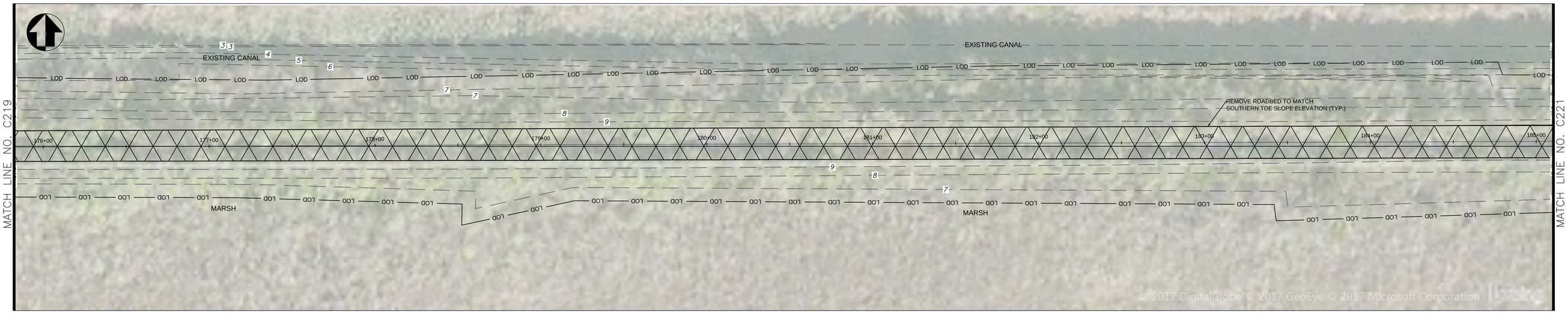
30 0 30 60
SCALE IN FEET
1" = 30'

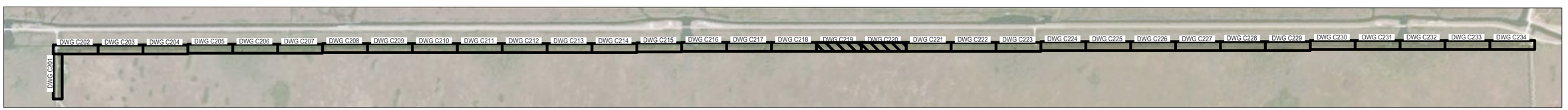
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C217–C218	TITLE OF SHEET ALTERNATIVE 1 – C217–C218 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 30 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017







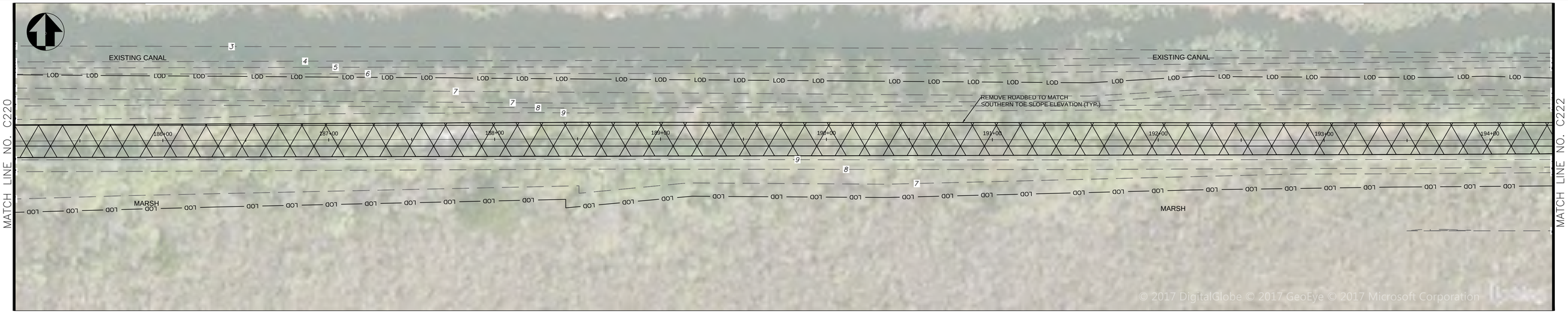
SHEET KEY
NOT TO SCALE

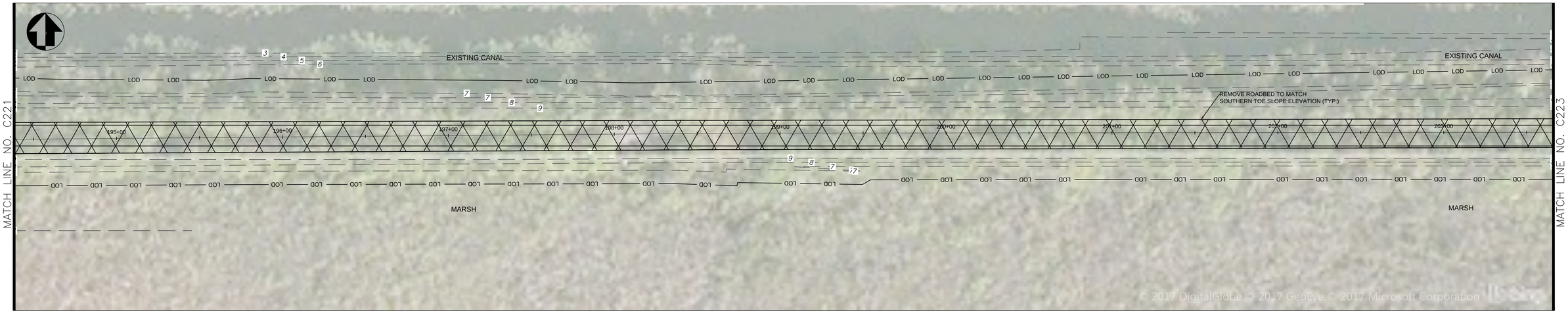
30 0 30 60
SCALE IN FEET
1" = 30'

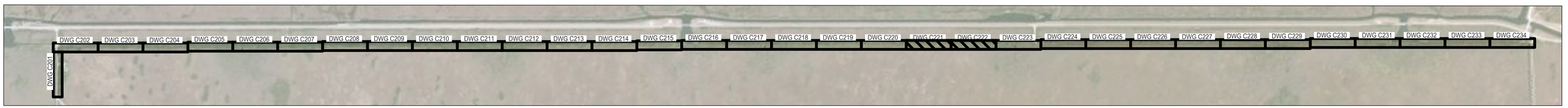
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI DRAWN: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C219–C220	TITLE OF SHEET ALTERNATIVE 1 – C219–C220 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 31 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017







SHEET KEY

NOT TO SCALE

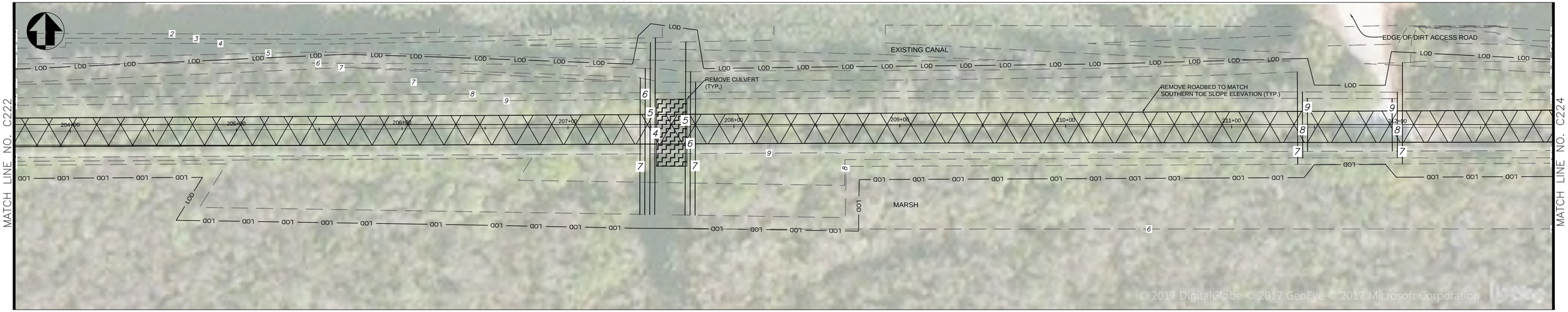
30 0 30 60

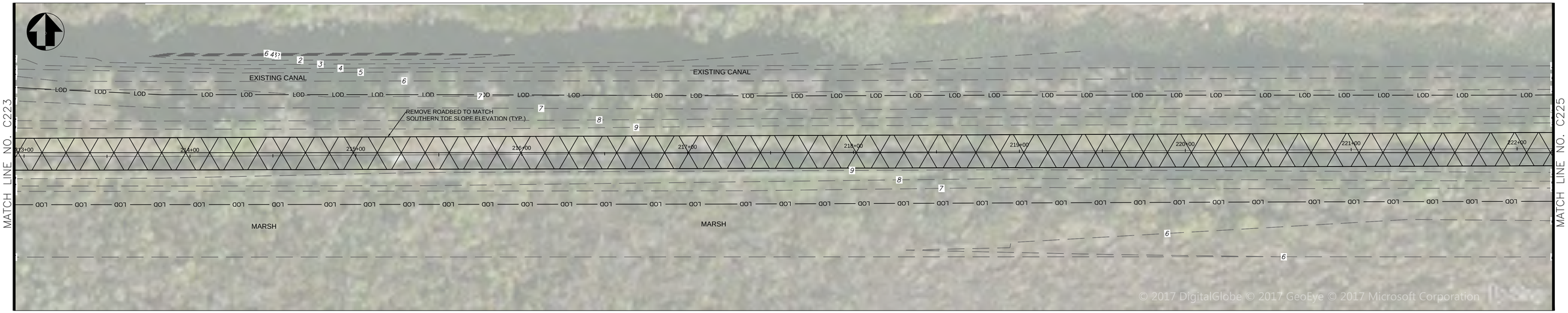
SCALE IN FEET
1" = 30'

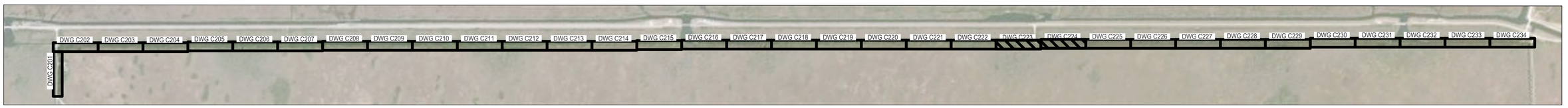
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C221–C222	TITLE OF SHEET ALTERNATIVE 1 – C221–C222 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 32 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017







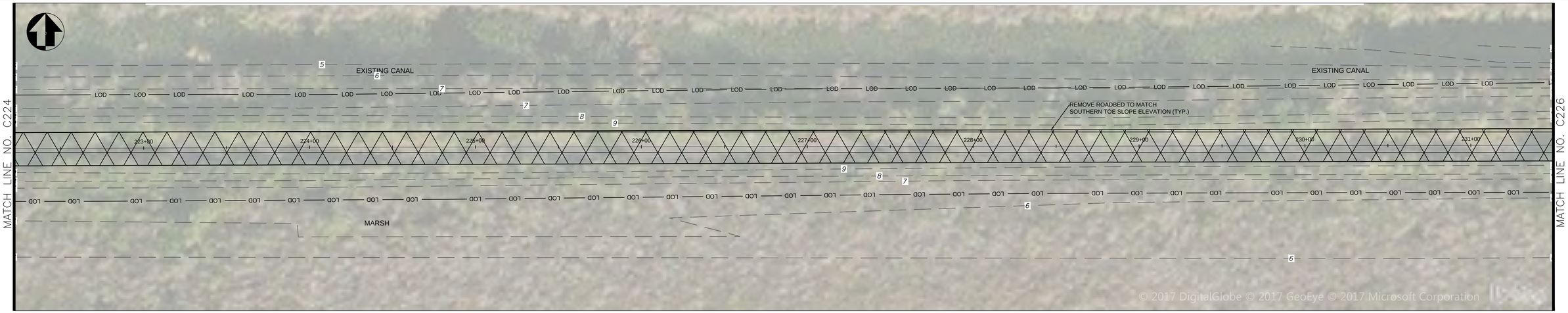
SHEET KEY
NOT TO SCALE

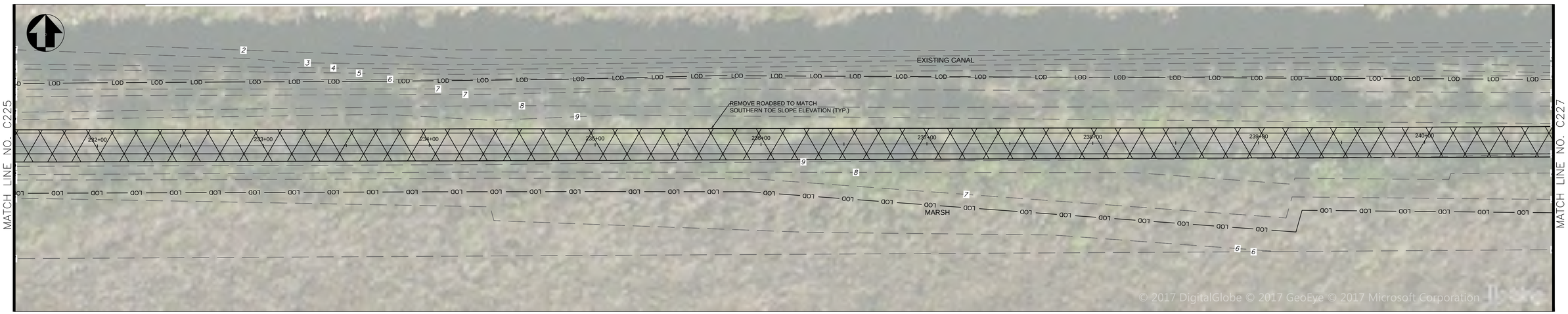
30 0 30 60
SCALE IN FEET
1" = 30'

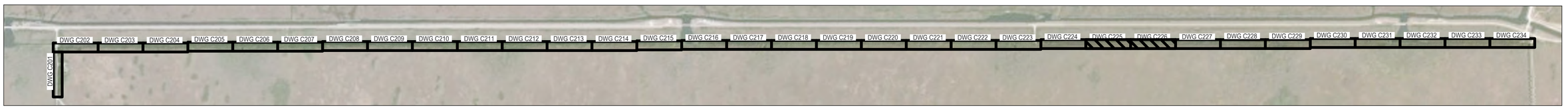
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C223–C224	TITLE OF SHEET ALTERNATIVE 1 – C223–C224 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 33 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Angns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017







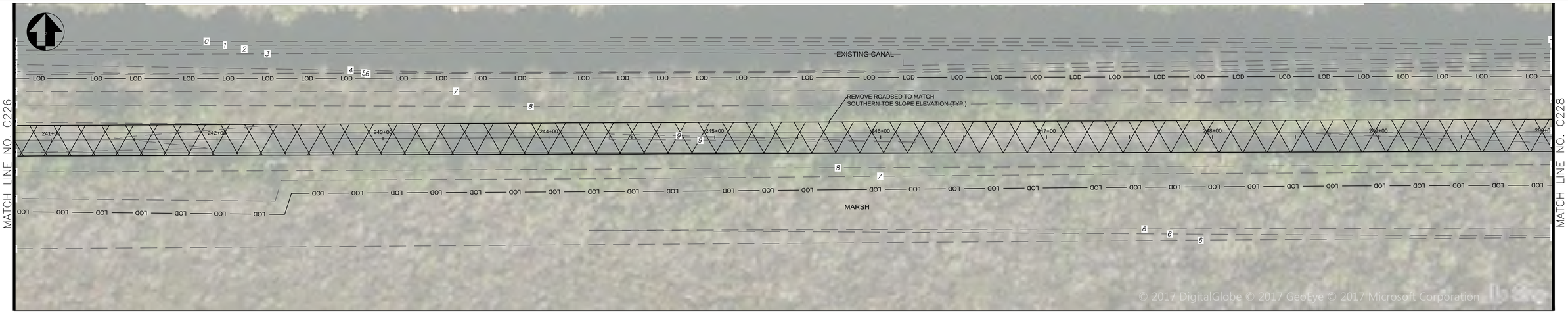
SHEET KEY
NOT TO SCALE

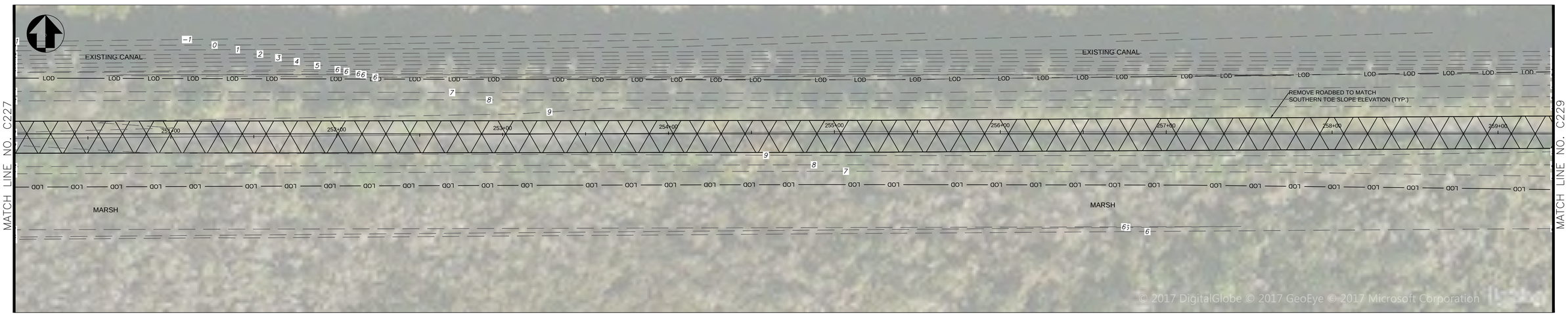
30 0 30 60
SCALE IN FEET
1" = 30'

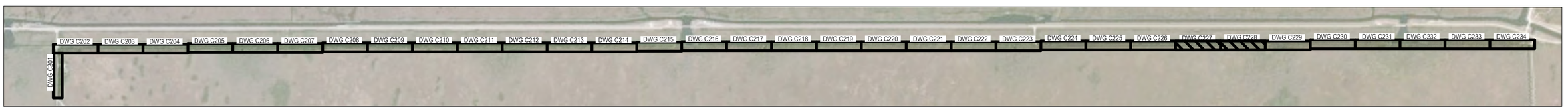
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C225–C226	TITLE OF SHEET ALTERNATIVE 1 – C225–C226 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 34 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 - Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017







SHEET KEY

NOT TO SCALE

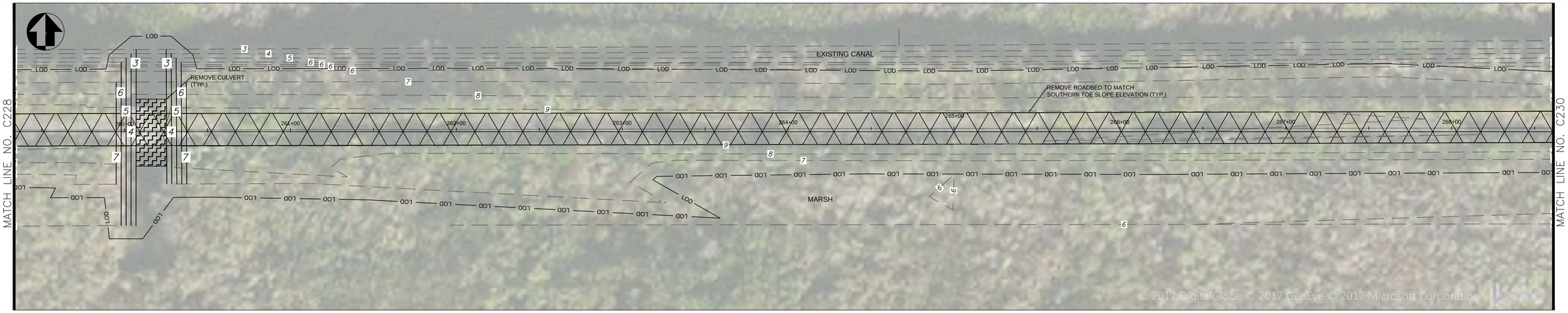
30 0 30 60

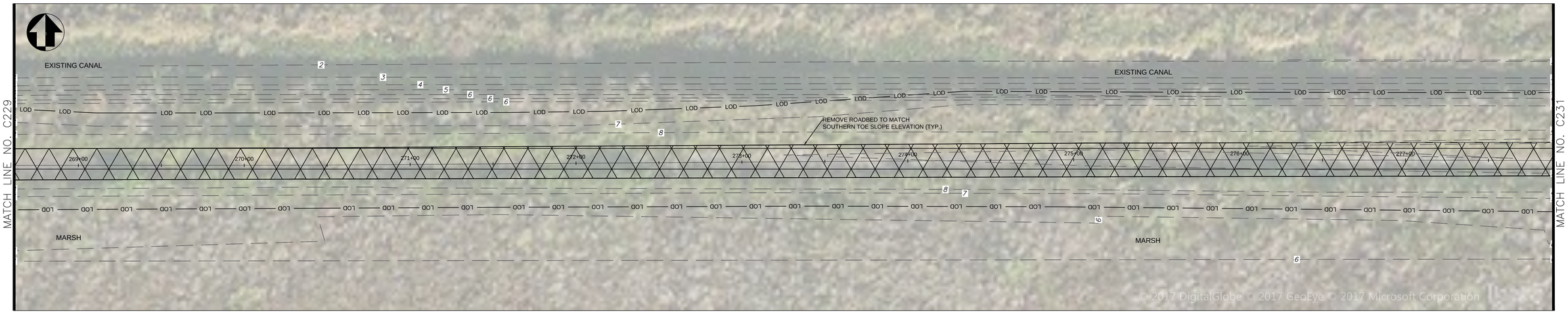
SCALE IN FEET
1" = 30'

30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C227–C228	TITLE OF SHEET ALTERNATIVE 1 – C227–C228 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 35 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Anggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017





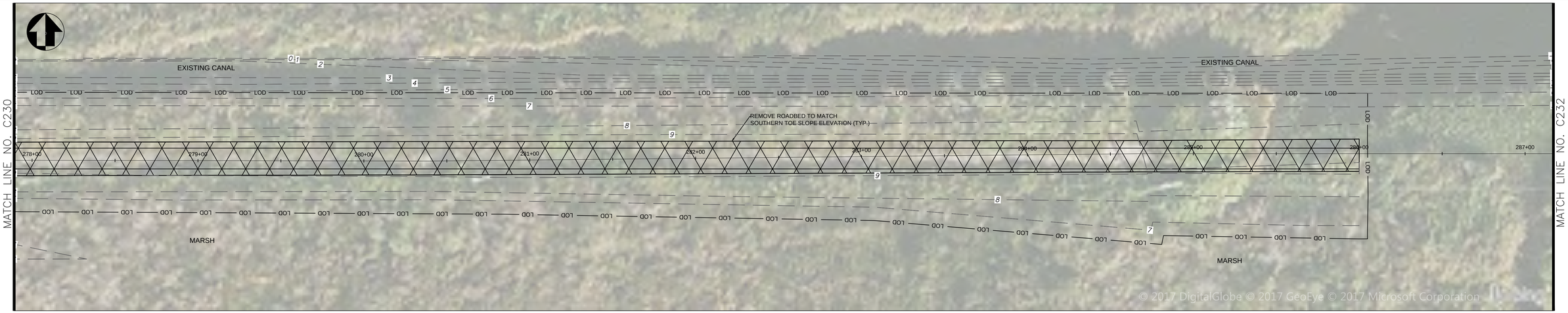
SHEET KEY
NOT TO SCALE

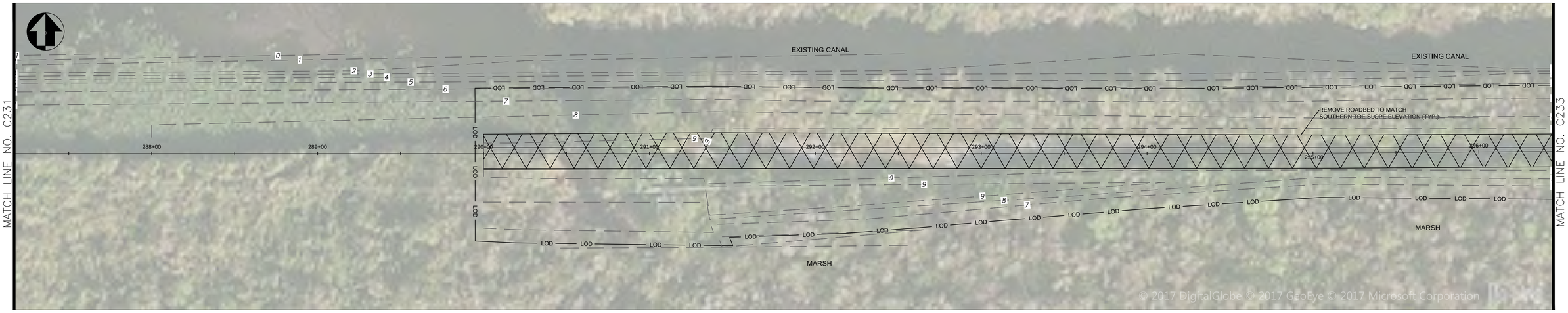
30 0 30 60
SCALE IN FEET
1" = 30'

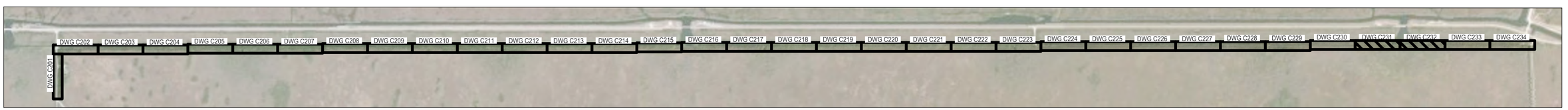
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C229–C230	TITLE OF SHEET ALTERNATIVE 1 – C229–C230 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 36 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017







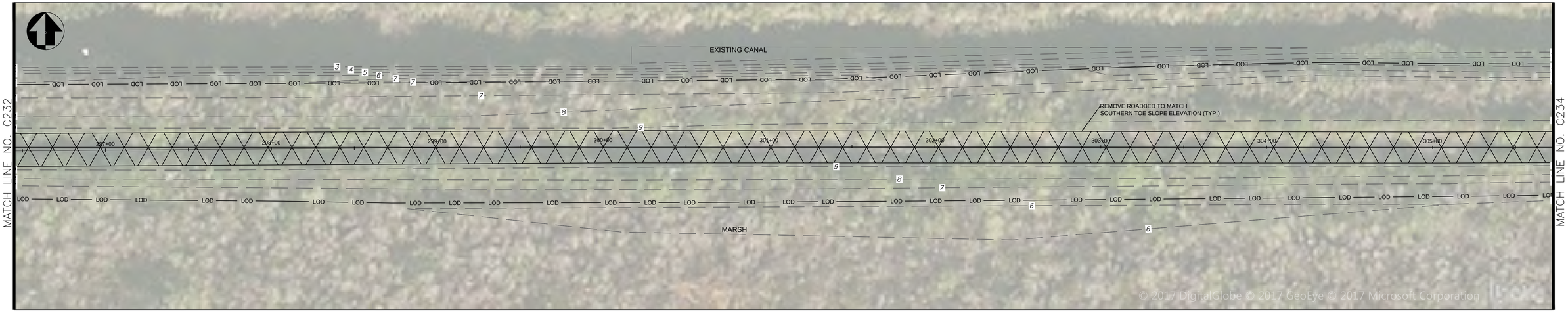
SHEET KEY
NOT TO SCALE

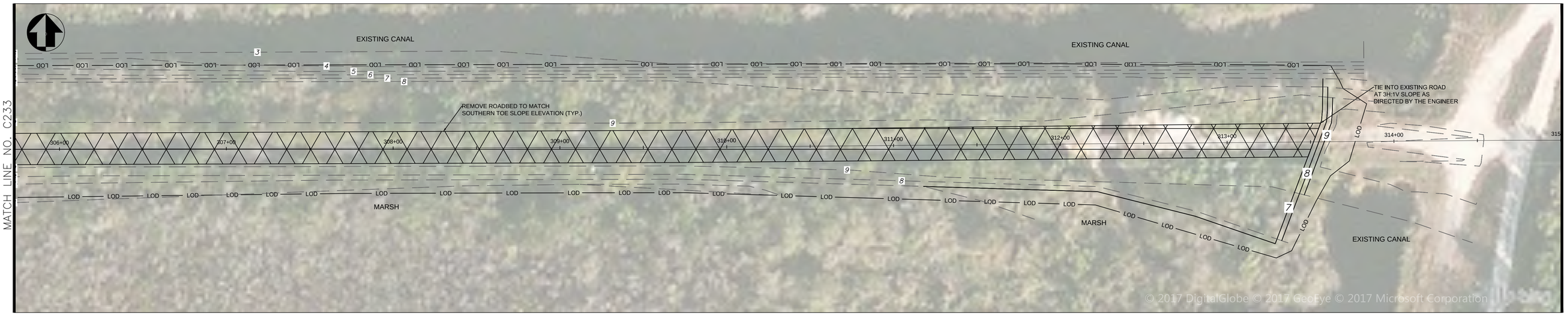
30 0 30 60
SCALE IN FEET
1" = 30'

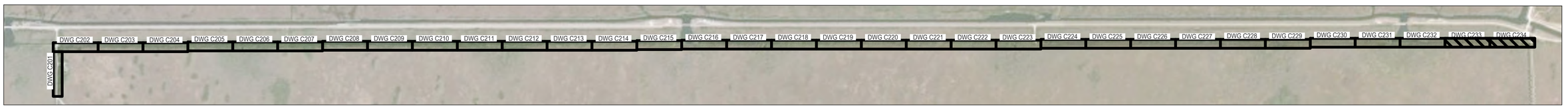
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C231–C232	TITLE OF SHEET ALTERNATIVE 1 – C231–C232 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 37 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017







SHEET KEY
NOT TO SCALE

30 0 30 60
SCALE IN FEET
1" = 30'

30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C233–C234	TITLE OF SHEET ALTERNATIVE 1 – C233–C234 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 38 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Angns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 1.dwg Nov 22, 2017

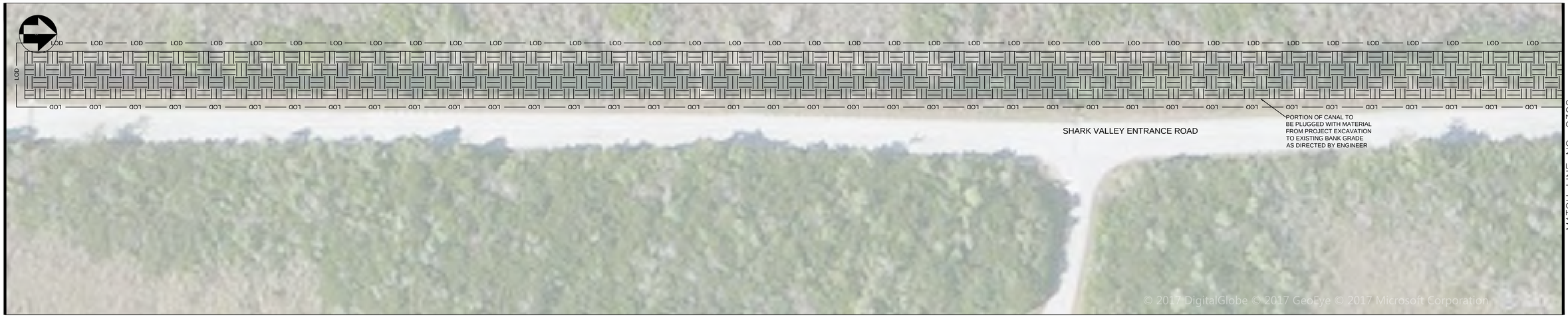
1100 0 1100 2200

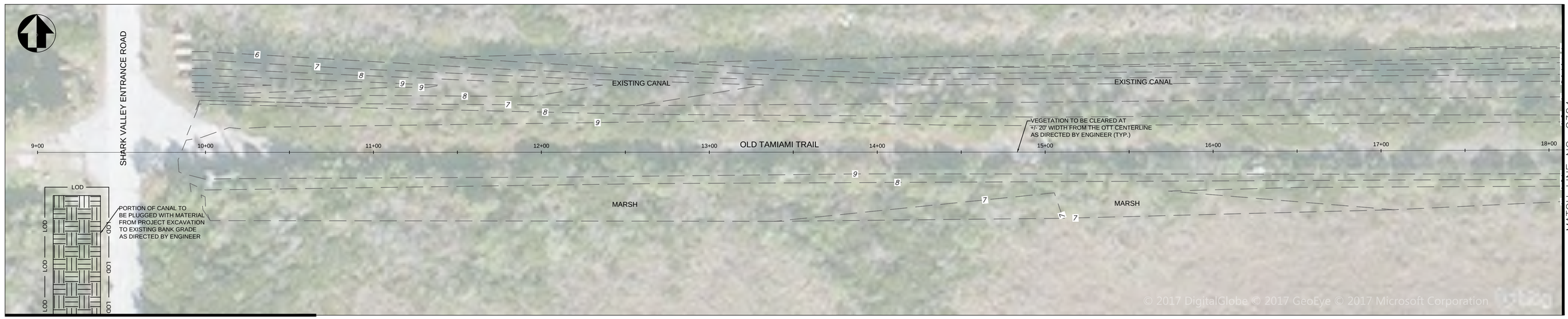
SCALE IN FEET
1" = 1100'

30% PLANS NOT FOR CONSTRUCTION

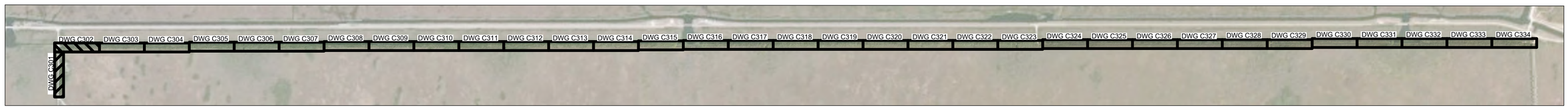
DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO.	TITLE OF SHEET ALTERNATIVE 2 KEY PLAN OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 39 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 - Copy\Plot\ALTERNATIVE 2.dwg Nov 22, 2017





MATCH LINE NO. C301



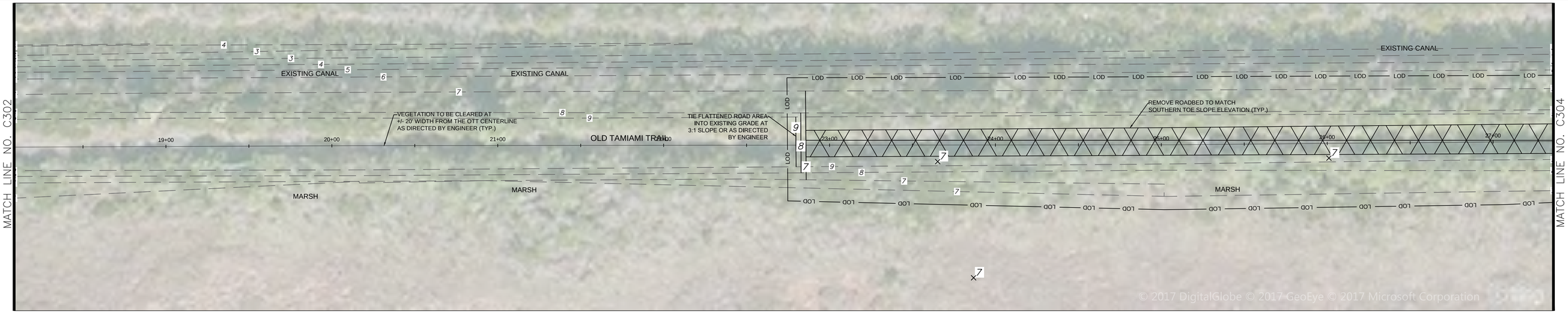
SHEET KEY
NOT TO SCALE

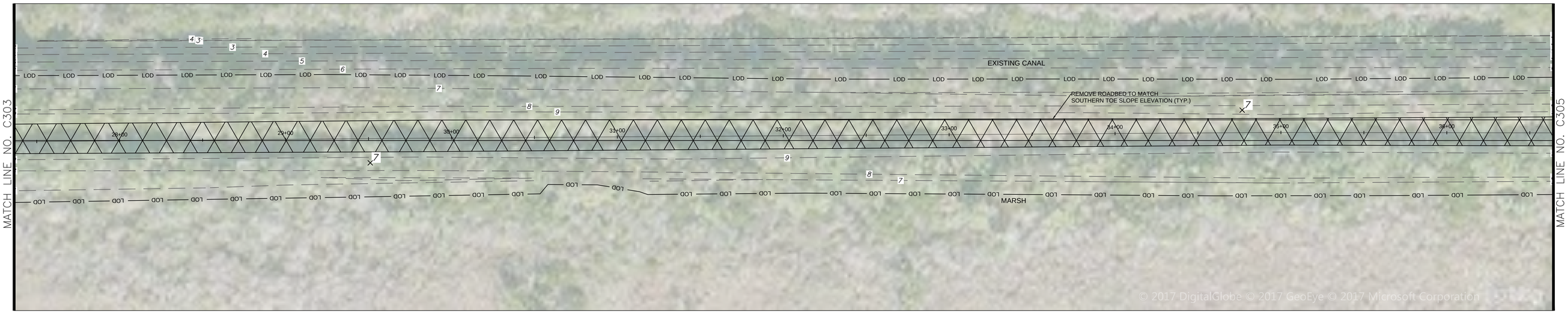
30 0 30 60
SCALE IN FEET
1" = 30'

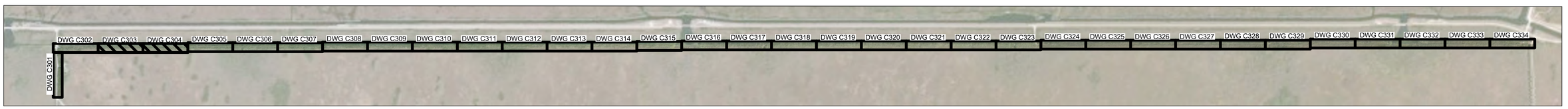
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C301–C302	TITLE OF SHEET ALTERNATIVE 2 – C301–C302 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 40 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 2.dwg Nov 22, 2017







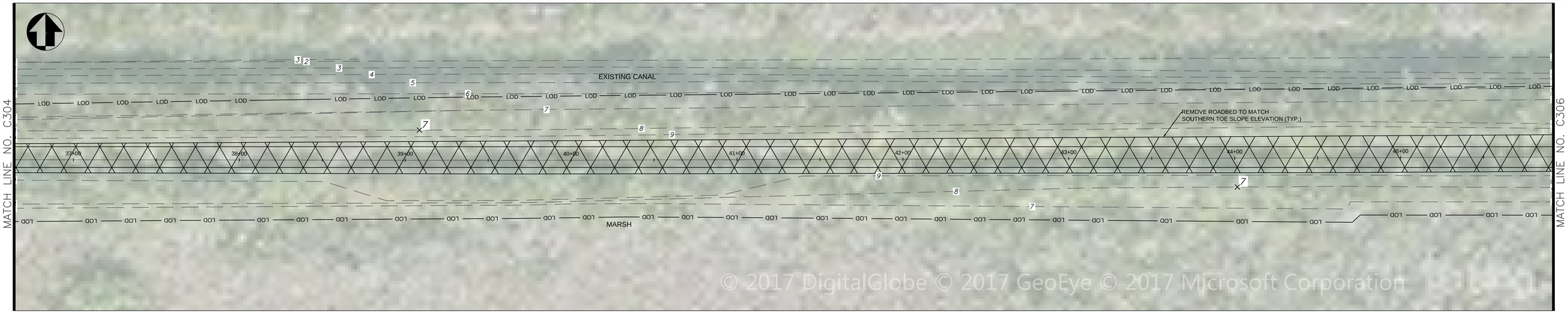
SHEET KEY
NOT TO SCALE

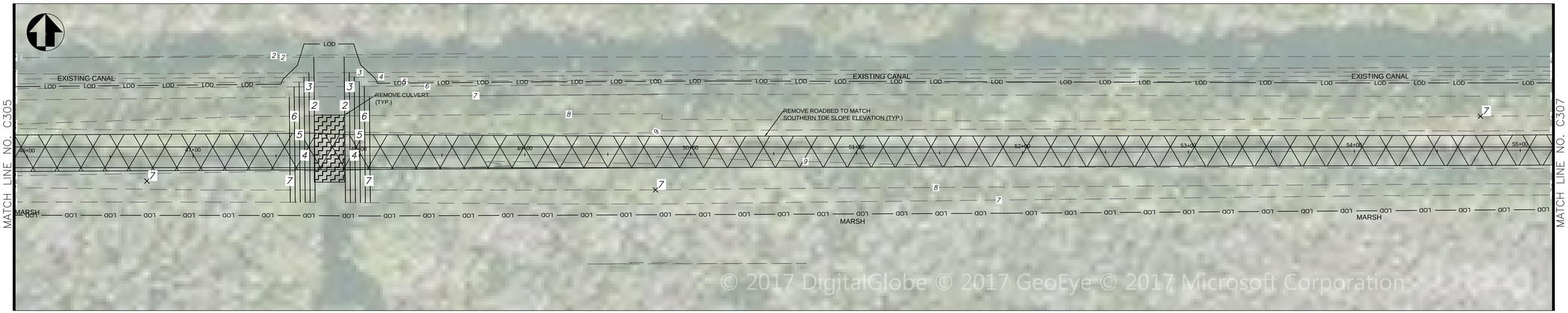
30 0 30 60
SCALE IN FEET
1" = 30'

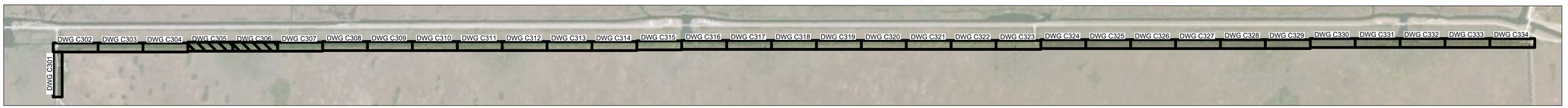
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C303–C304	TITLE OF SHEET ALTERNATIVE 2 – C303–C304 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 41 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 2.dwg Nov 22, 2017







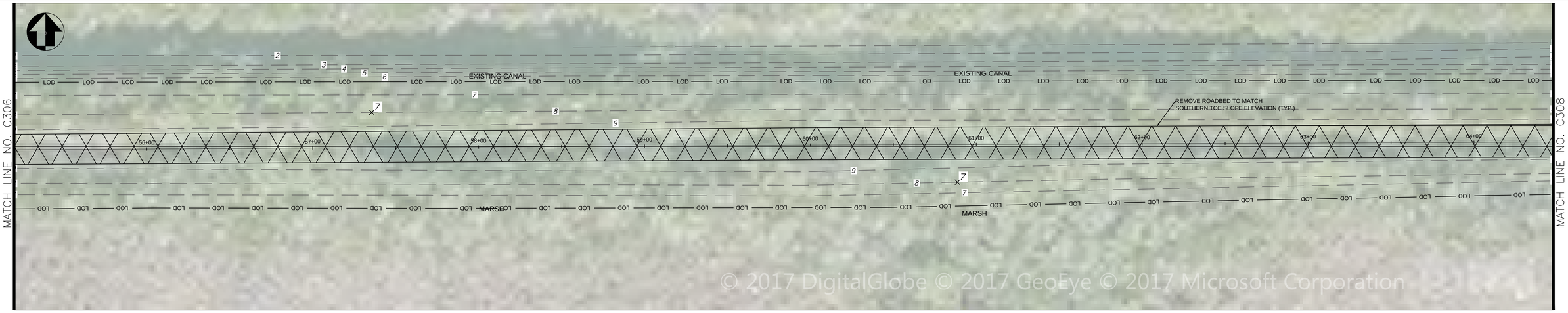
SHEET KEY
NOT TO SCALE

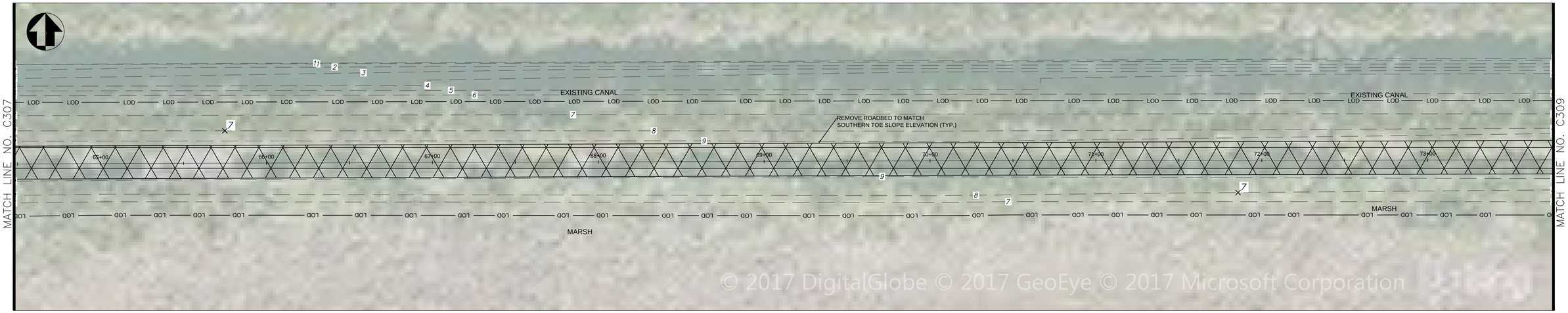
30 0 30 60
SCALE IN FEET
1" = 30'

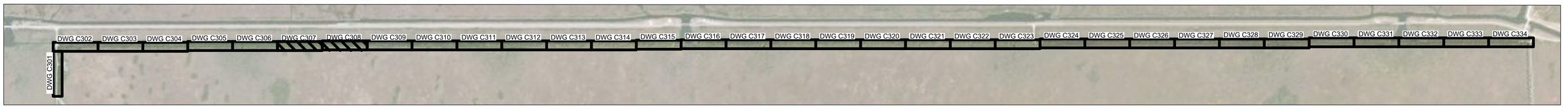
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C305–C306	TITLE OF SHEET ALTERNATIVE 2 – C305–C306 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 42 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 2.dwg Nov 22, 2017







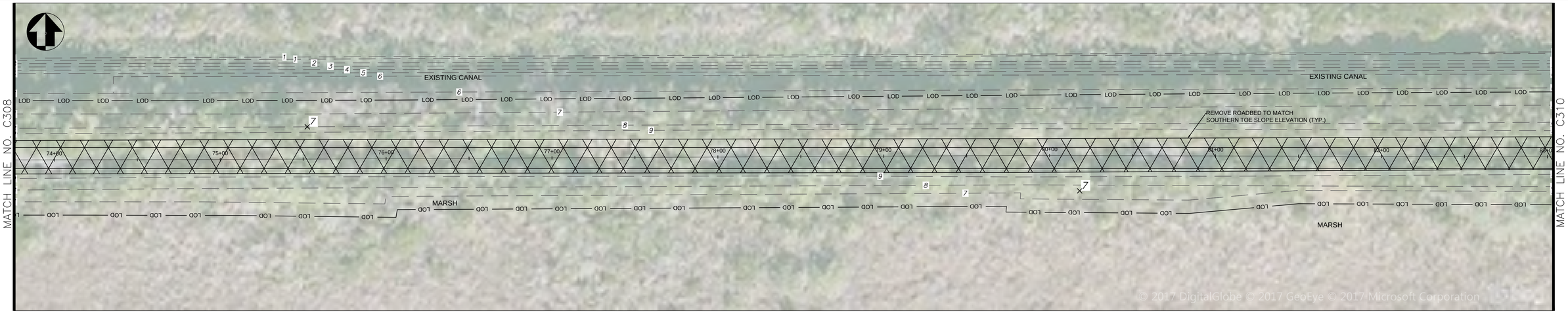
SHEET KEY
NOT TO SCALE

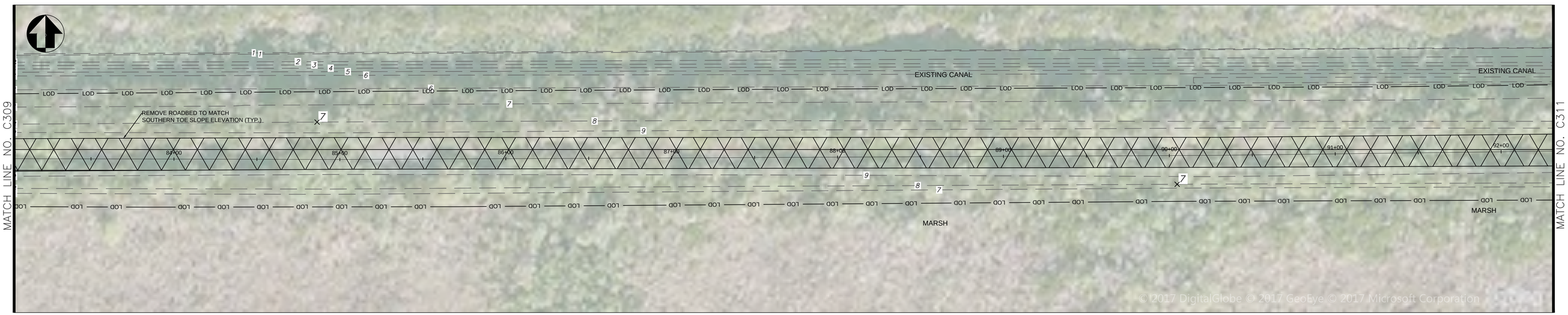
30 0 30 60
SCALE IN FEET
1" = 30'

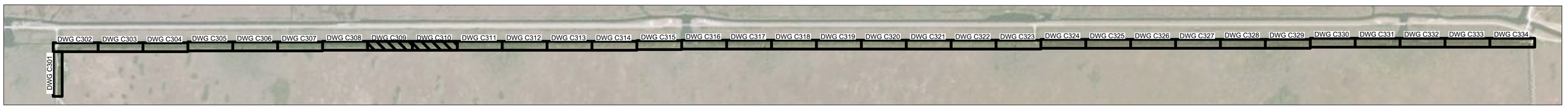
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C307–C308	TITLE OF SHEET ALTERNATIVE 2 – C307–C308 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 43 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Angns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 2.dwg Nov 22, 2017







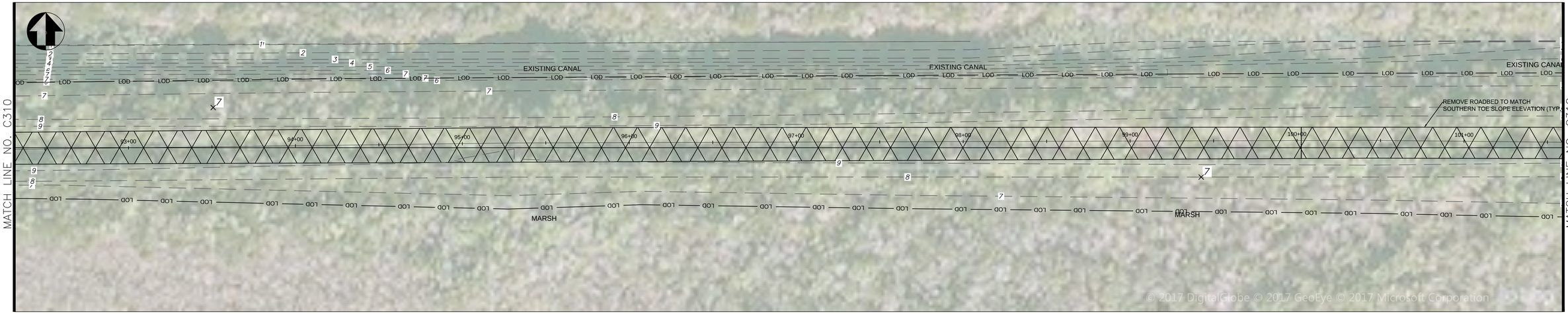
SHEET KEY
NOT TO SCALE

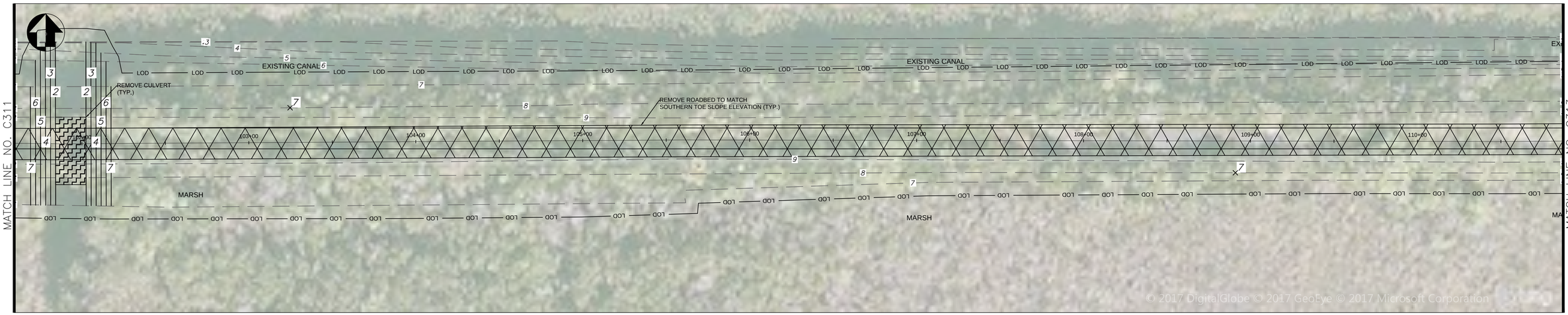
30 0 30 60
SCALE IN FEET
1" = 30'

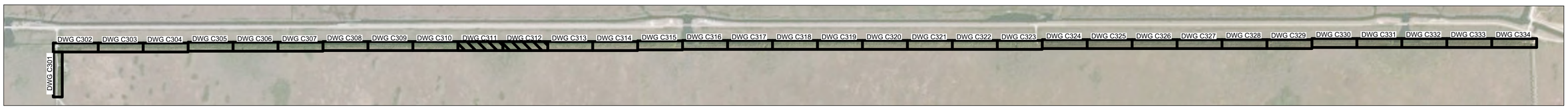
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI DRAWN: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C309–C310	TITLE OF SHEET ALTERNATIVE 2 – C309–C310 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 44 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 2.dwg Nov 22, 2017







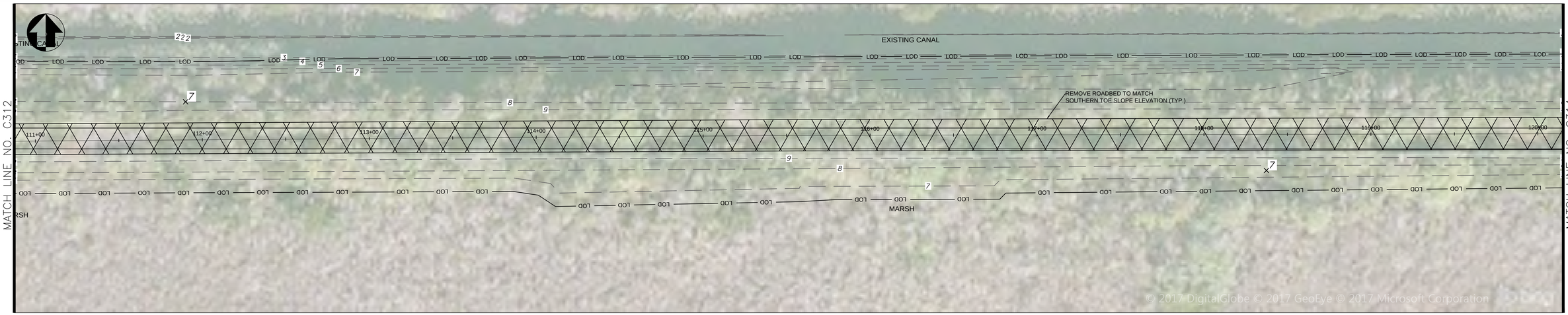
SHEET KEY
NOT TO SCALE

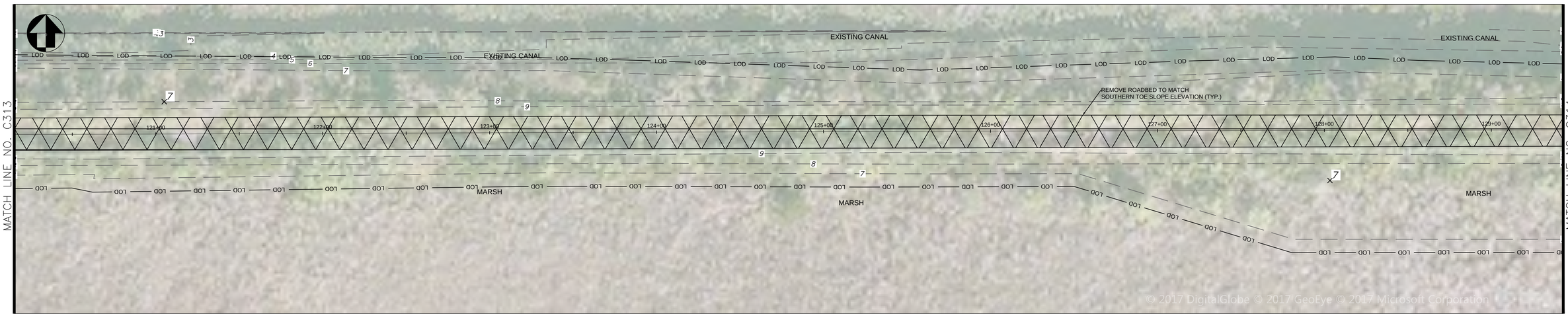
30 0 30 60
SCALE IN FEET
1" = 30'

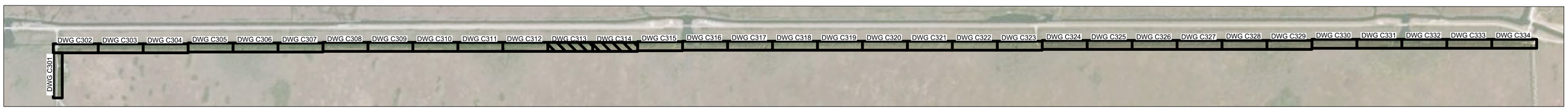
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C311–C312	TITLE OF SHEET ALTERNATIVE 2 – C311–C312 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 45 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Angns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 2.dwg Nov 22, 2017







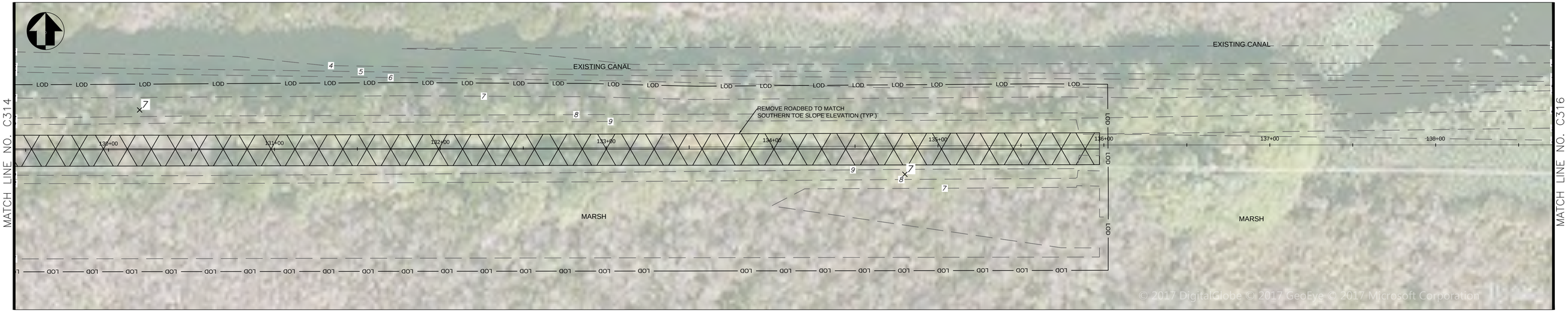
SHEET KEY
NOT TO SCALE

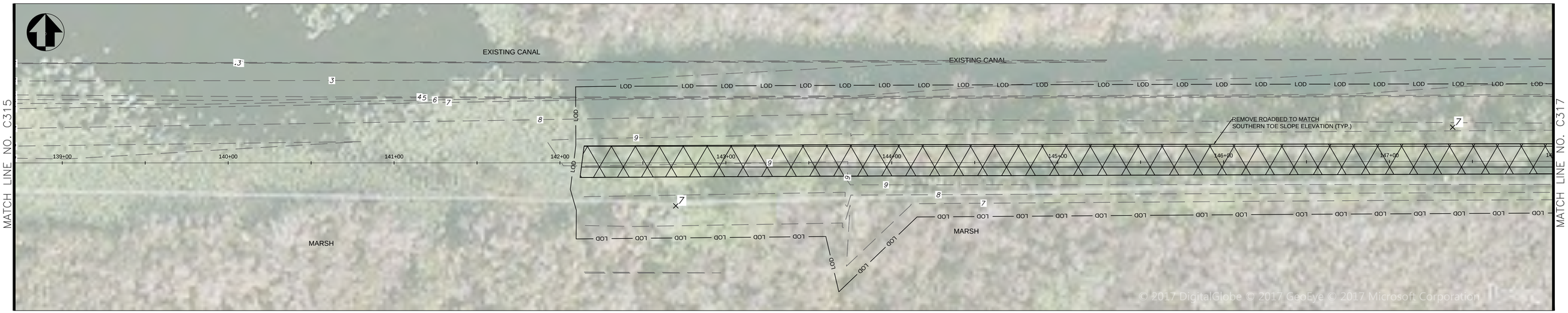
30 0 30 60
SCALE IN FEET
1" = 30'

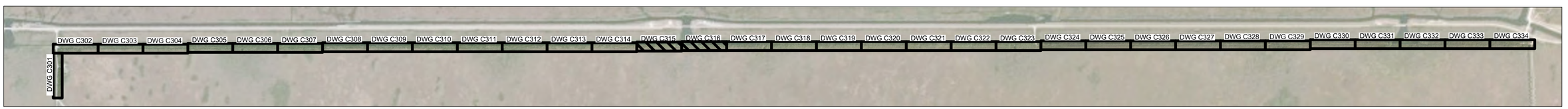
30% PLANS NOT FOR CONSTRUCTION

DESIGNED: AI CADD: AI TECH. REVIEW: BB DATE: 11/22/17	SUB SHEET NO. C313–C314	TITLE OF SHEET ALTERNATIVE 2 – C313–C314 – OLD TAMIAMI TRAIL MODIFICATIONS EVERGLADES NATIONAL PARK	DRAWING NO. EVER 160/ 139363 PMIS/PKG NO. 233902 SHEET 46 OF 58

LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Anggns\Everglades Old Tamiami\Drawings Revision_1 – Copy\Plot\ALTERNATIVE 2.dwg Nov 22, 2017







SHEET KEY

NOT TO SCALE

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SCALE IN FEET
1" = 30'

30% PLANS NOT FOR CONSTRUCTION

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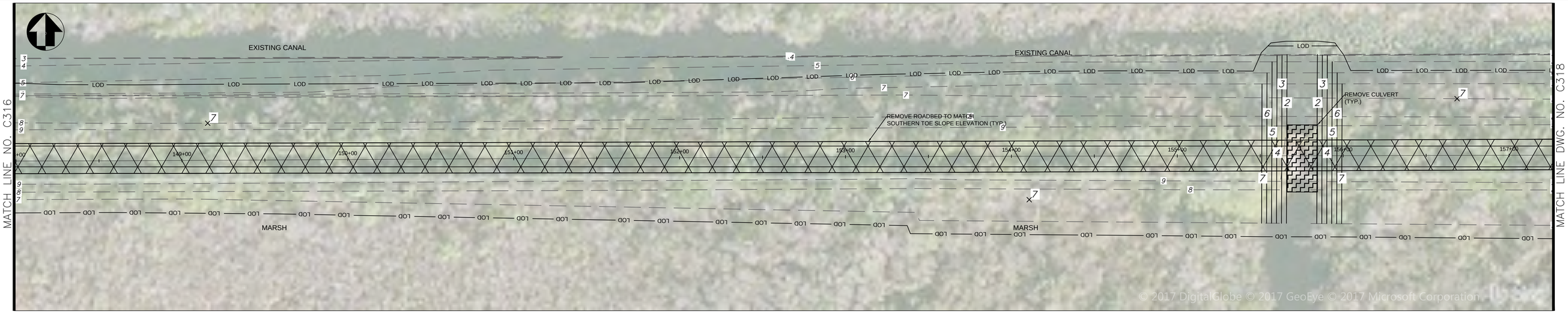

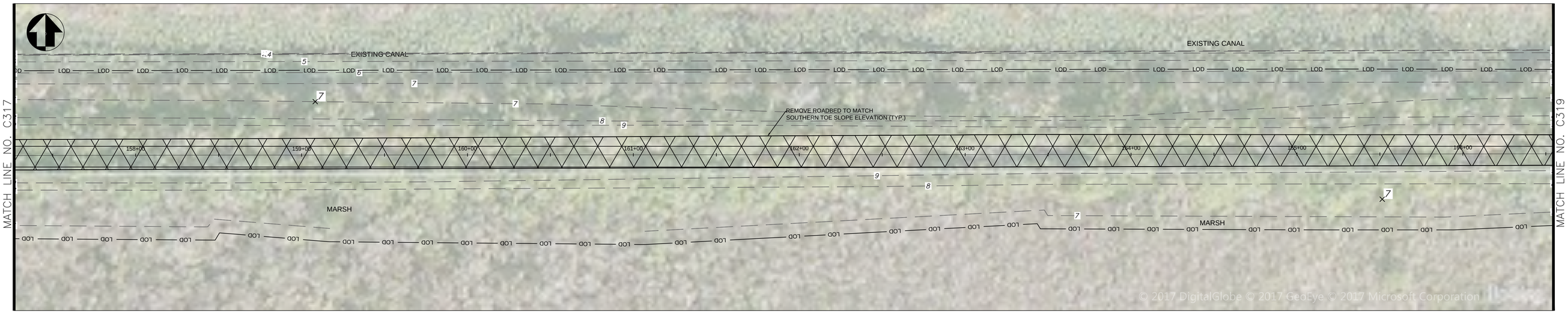

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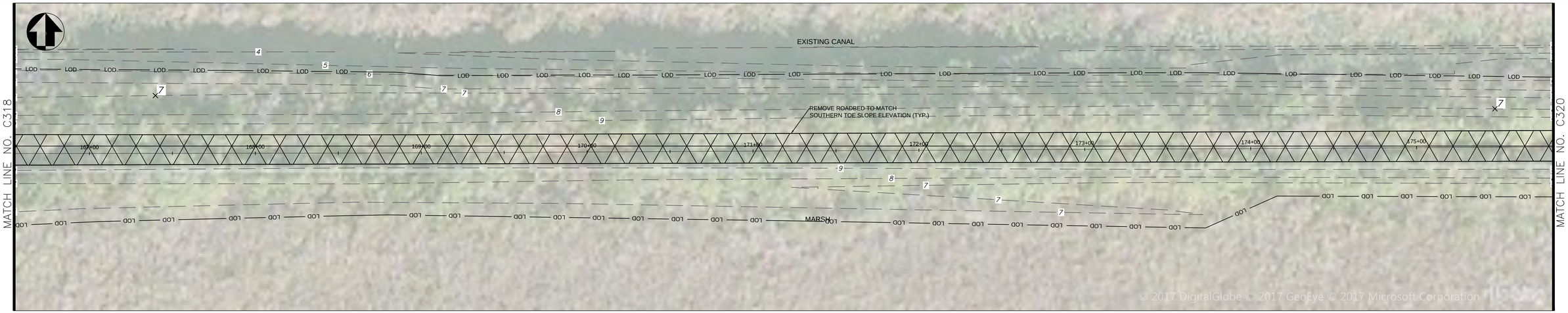

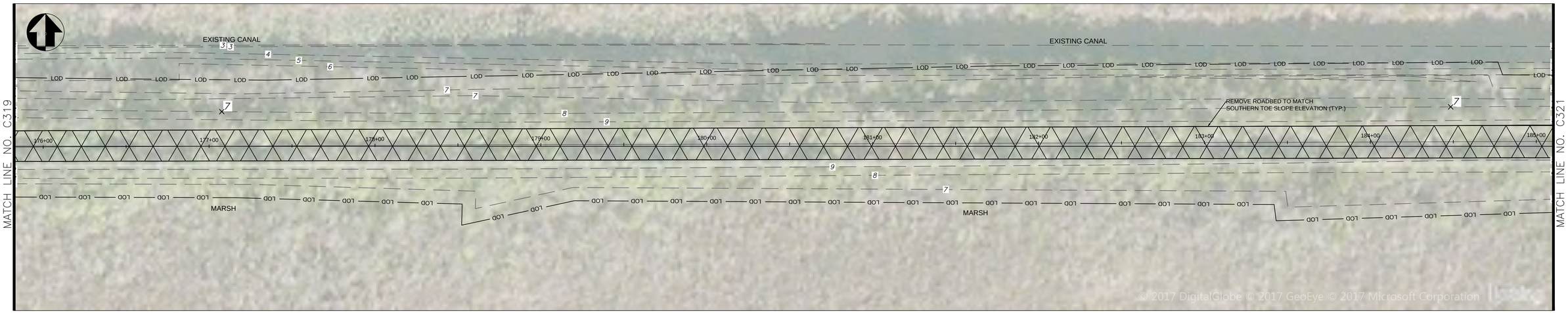

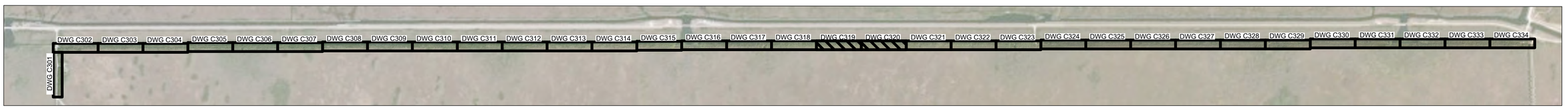

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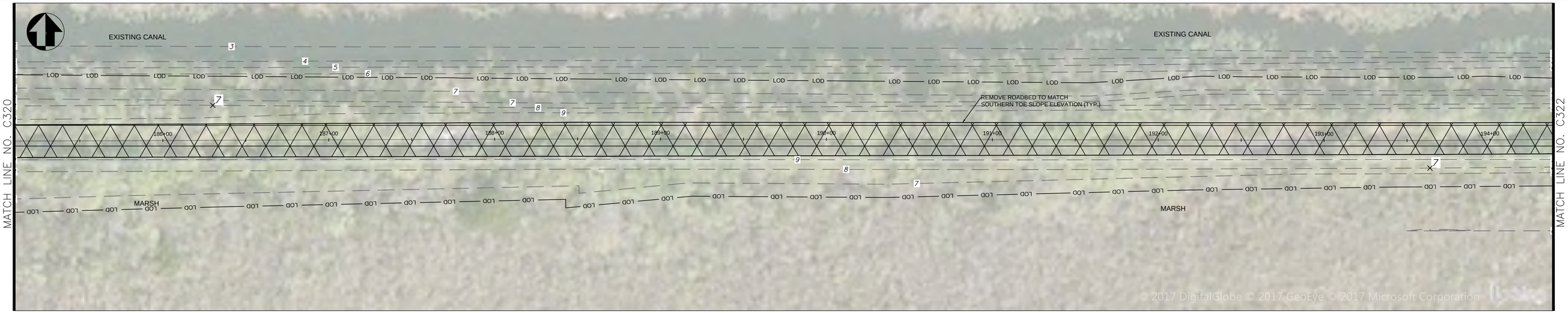

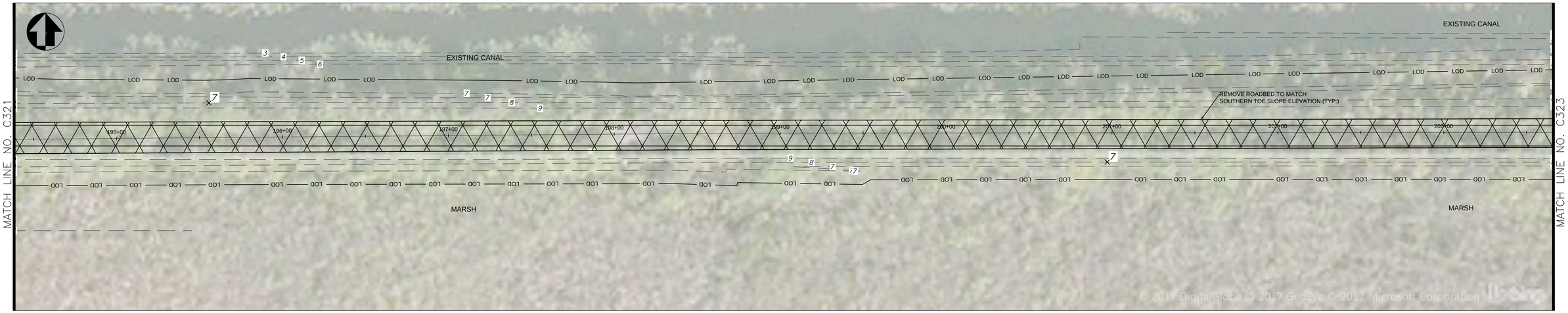

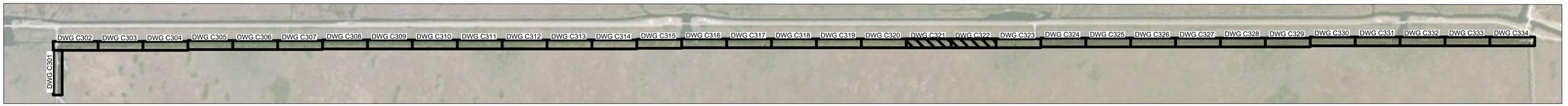

SHEET KEY

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30% PLANS NOT FOR CONSTRUCTION

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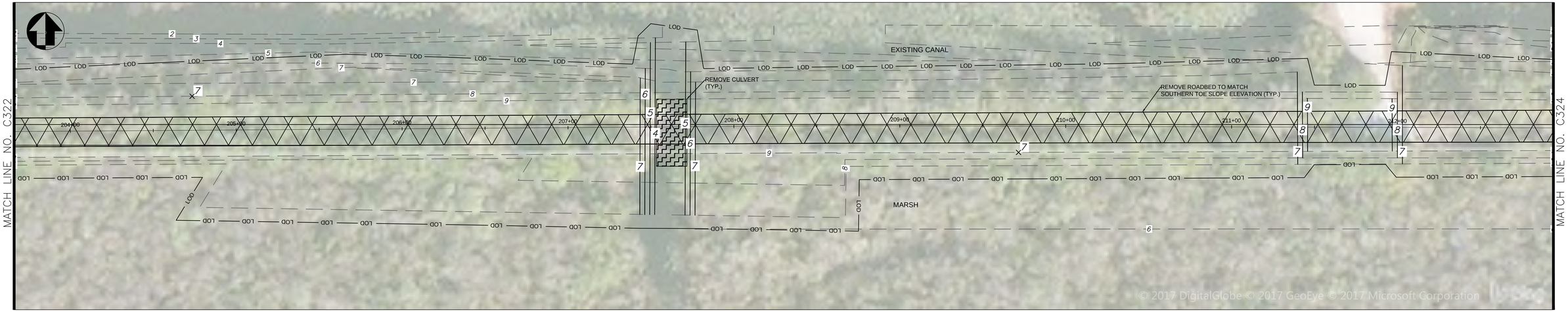

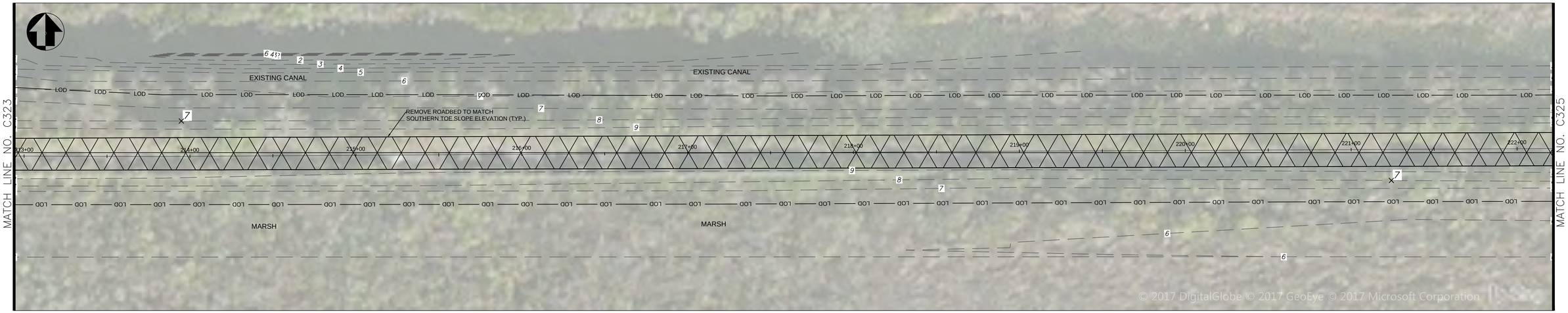

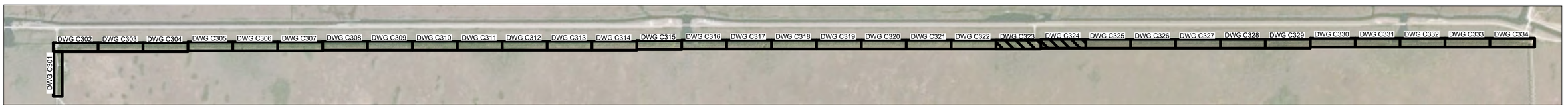

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1" = 30'

30% PLANS NOT FOR CONSTRUCTION

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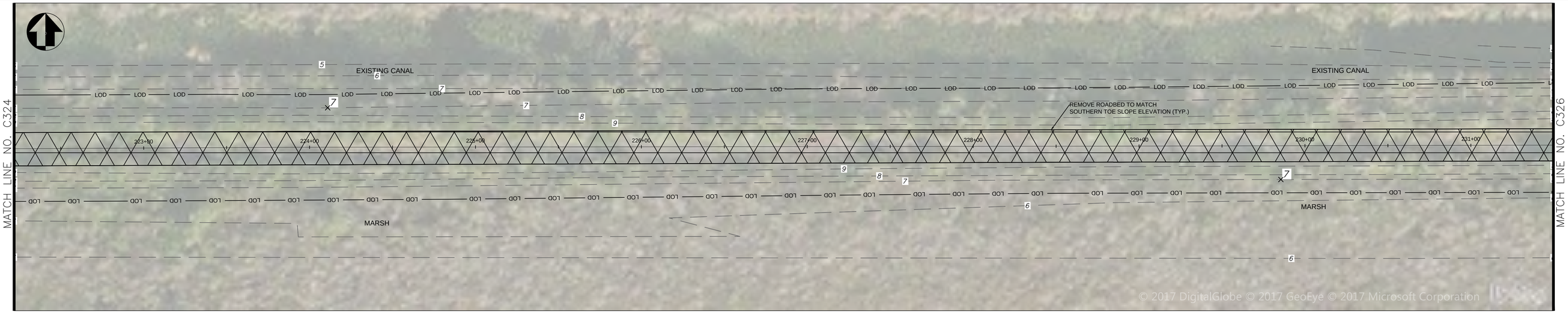

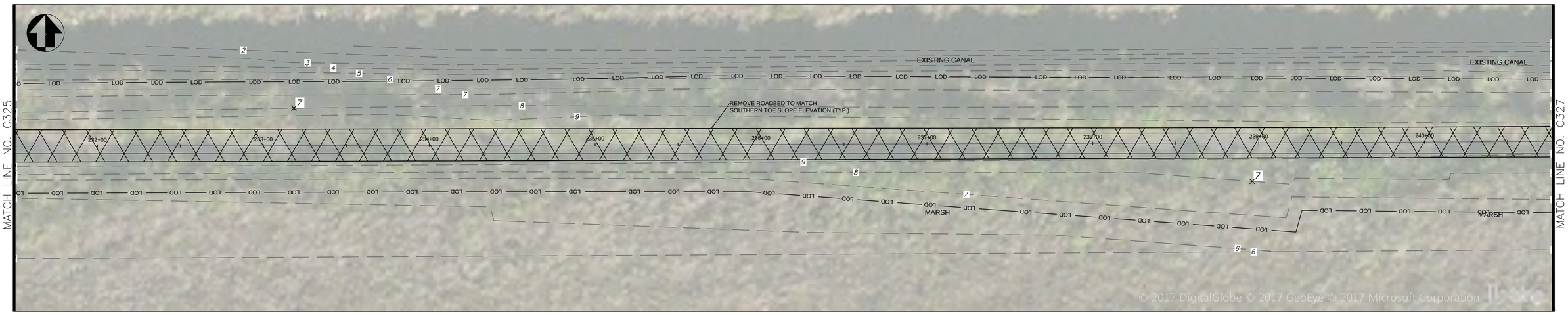

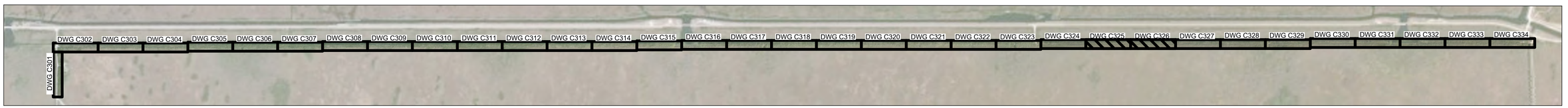

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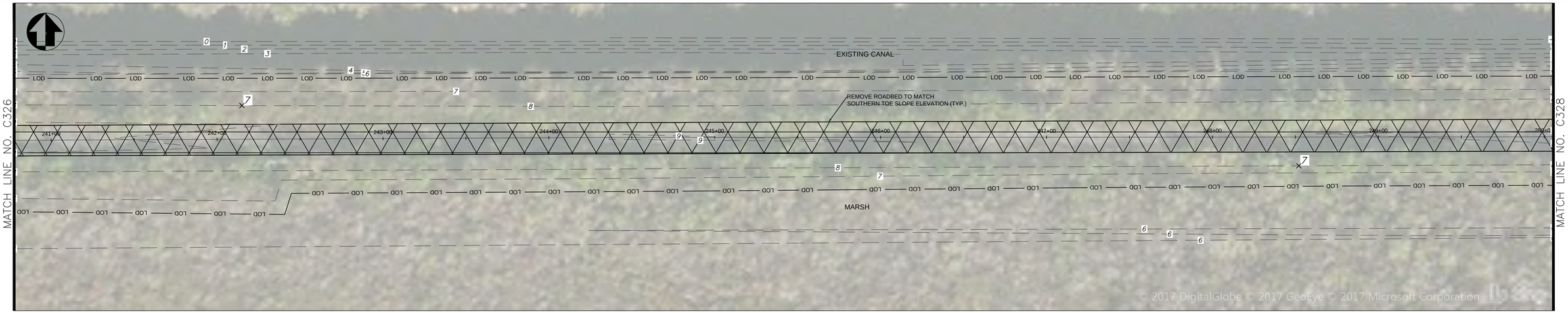

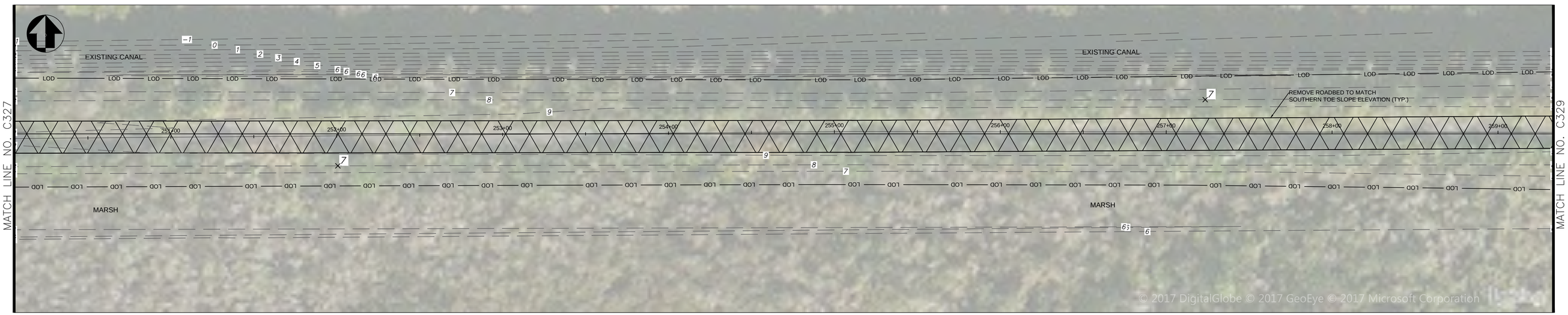

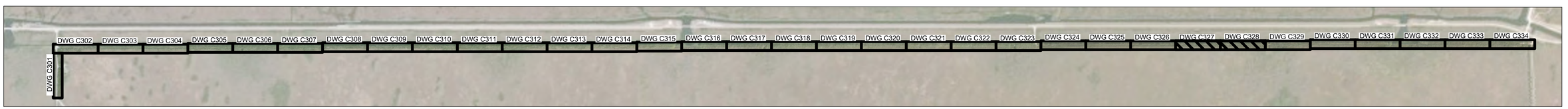

SHEET KEY
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1" = 30'

30% PLANS NOT FOR CONSTRUCTION

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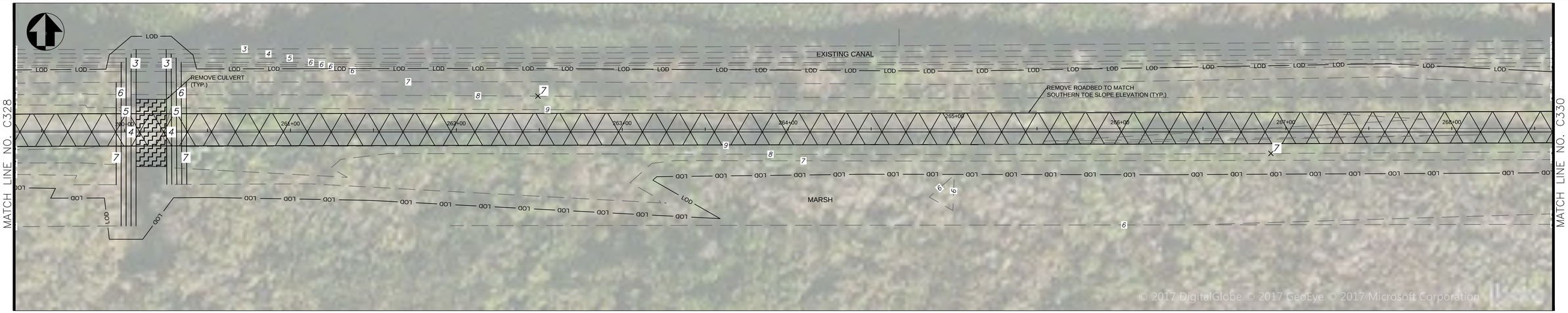

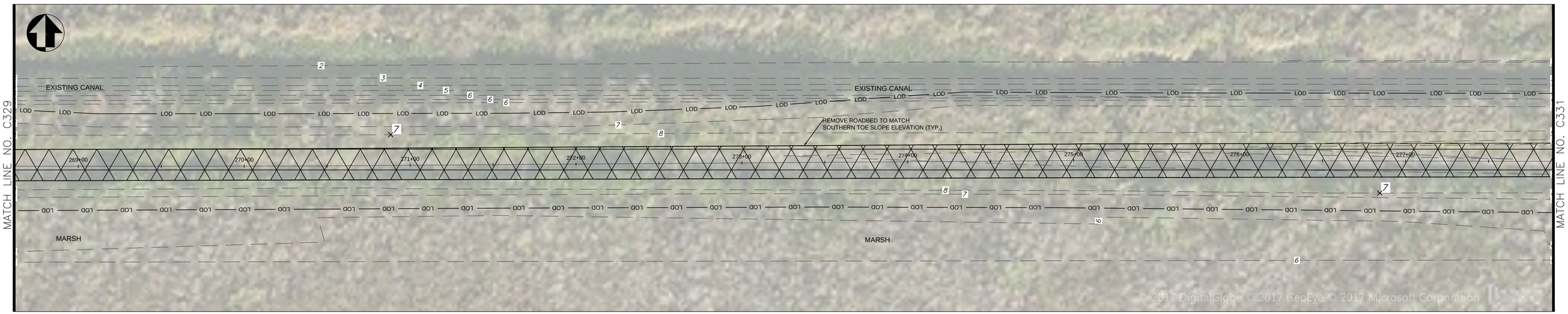

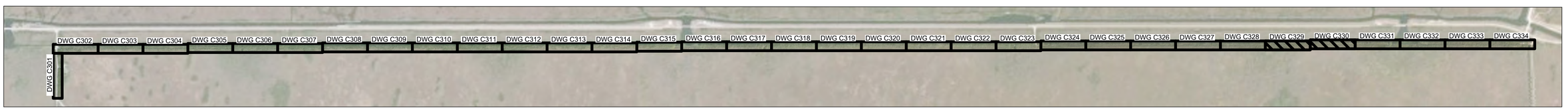

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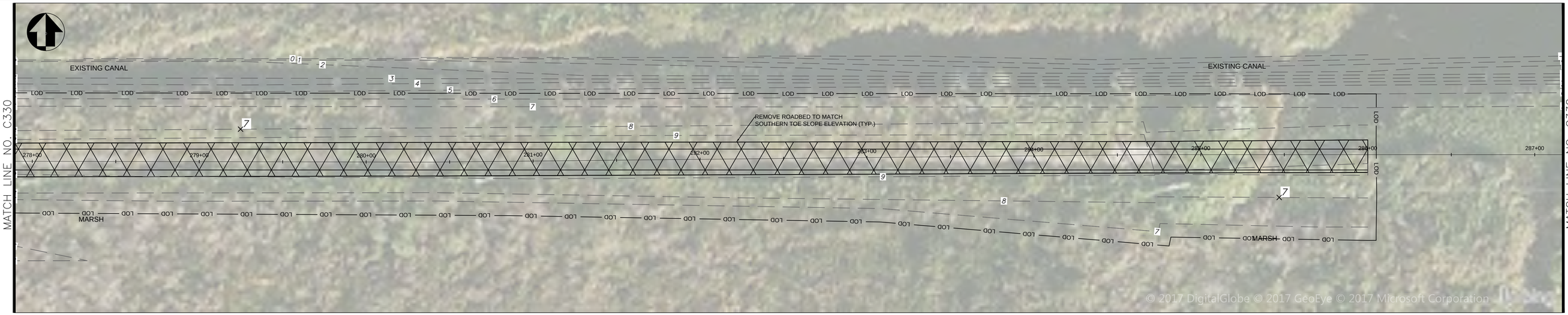

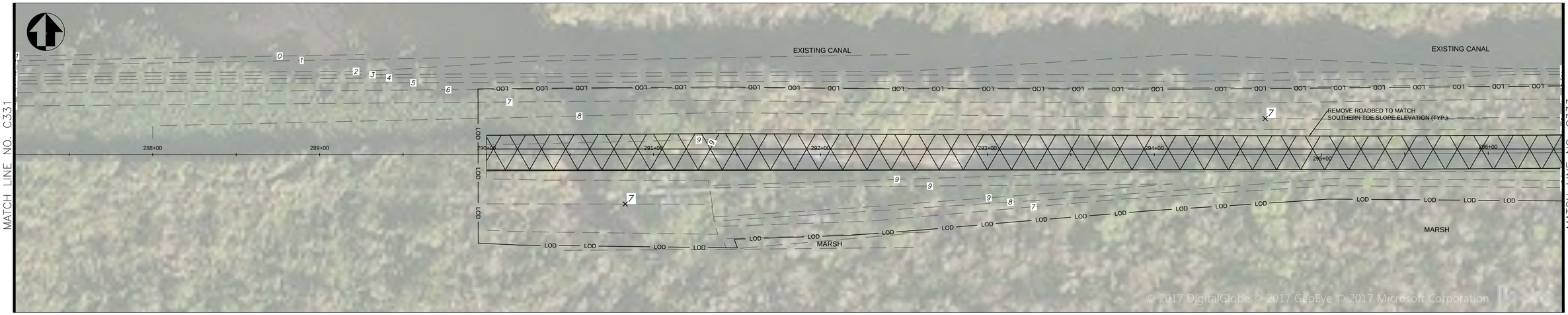

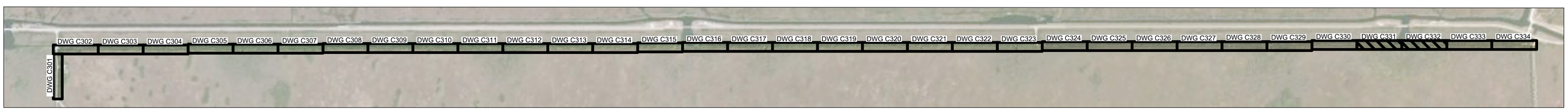

SHEET KEY
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SCALE IN FEET
1" = 30'

30% PLANS NOT FOR CONSTRUCTION

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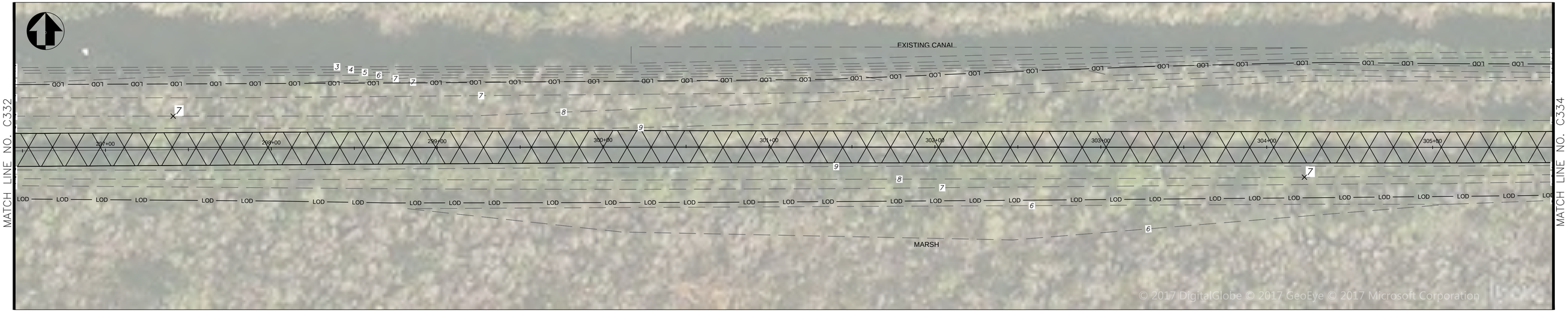

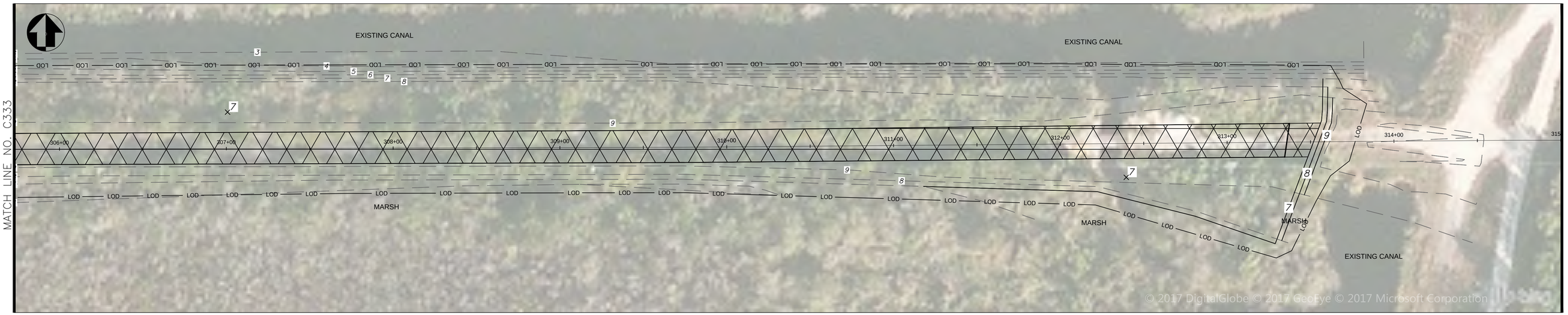

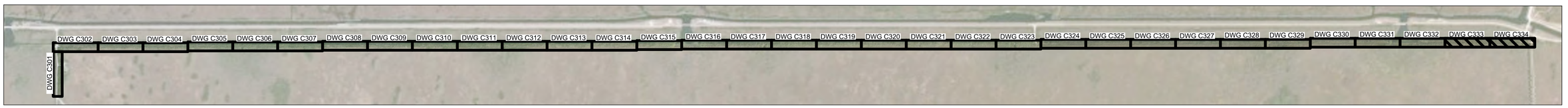

SHEET KEY
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1" = 30'

30% PLANS NOT FOR CONSTRUCTION

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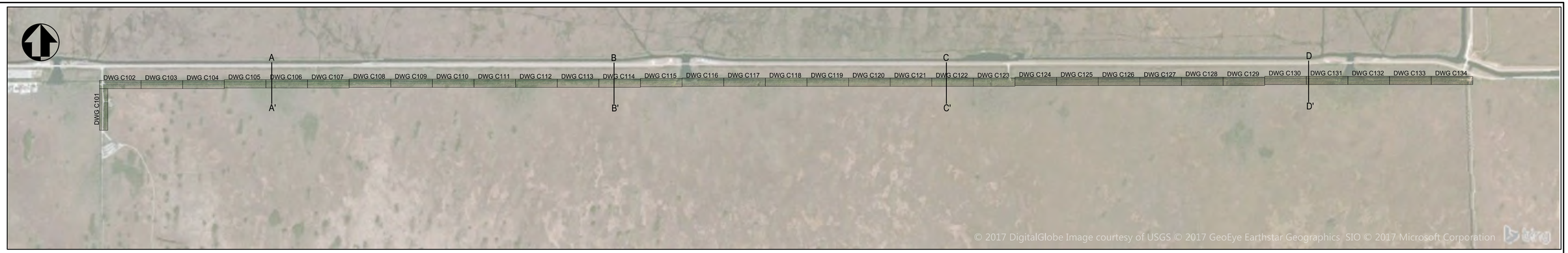
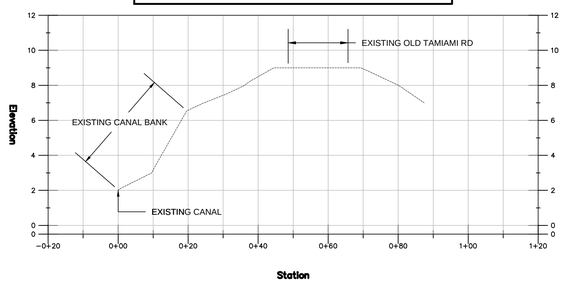


SHEET KEY

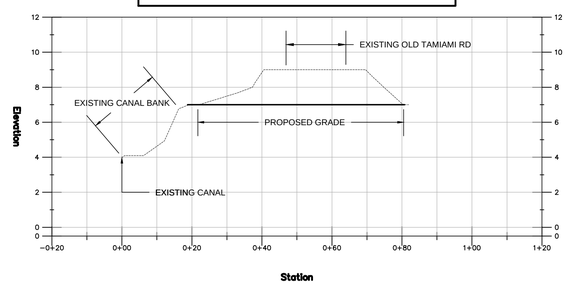
1100 0 1100 2200

SCALE IN FEET
1"= 1100'

TYPICAL SECTION A–A' – ALTERNATIVE 1 PROFILE



TYPICAL SECTION B–B' – ALTERNATIVE 1 PROFILE



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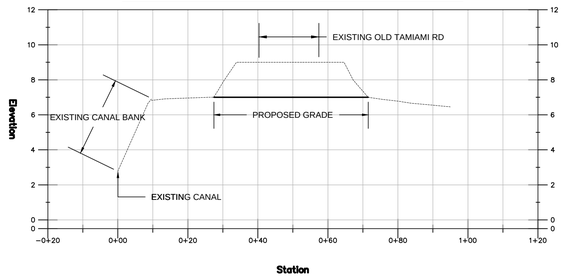

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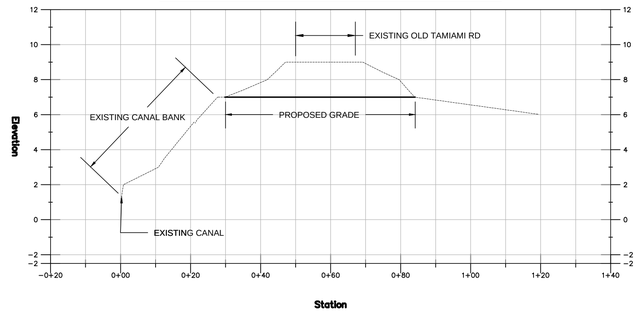

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VERT. 10 5 0 10 20
SECTION GRAPHIC SCALE

30% PLANS NOT FOR CONSTRUCTION

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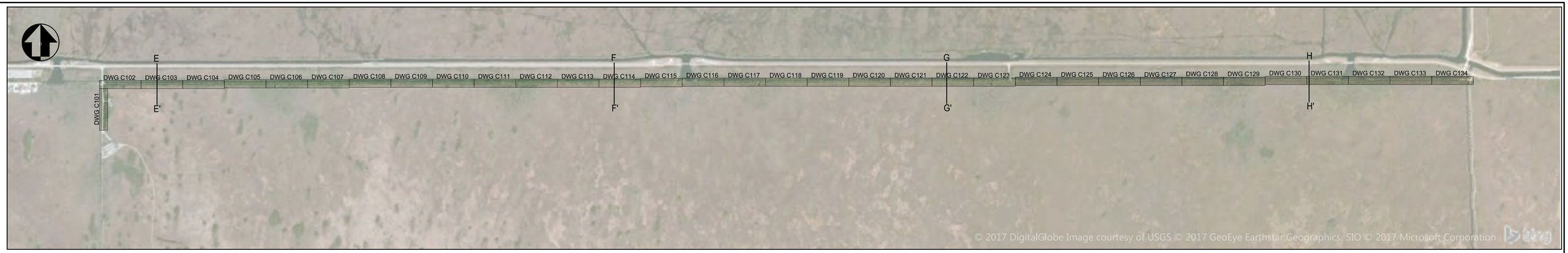

SHEET KEY

1100 0 1100 2200

SCALE IN FEET
1"= 1100'

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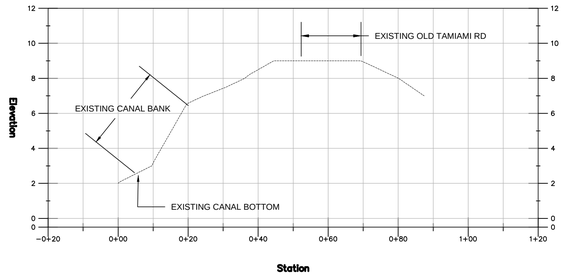

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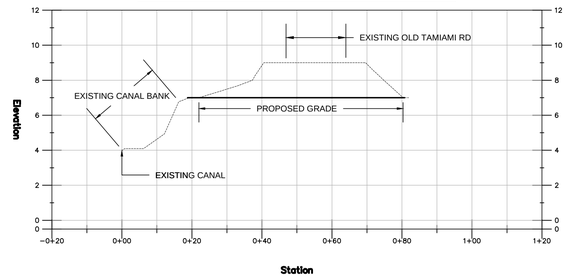

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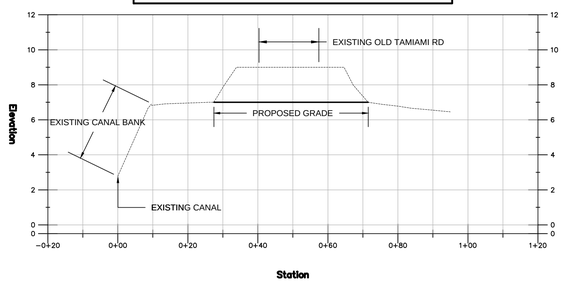

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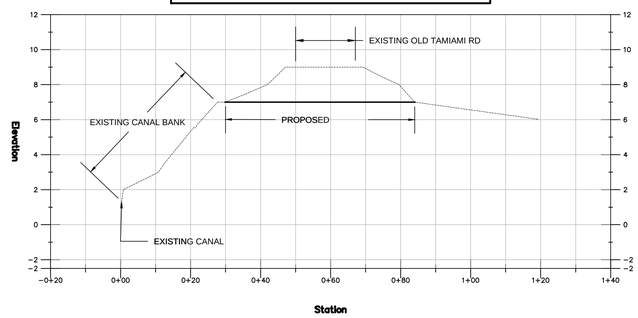

HORIZ. 50 25 0 50 100
VERT. 10 5 0 10 20
SECTION GRAPHIC SCALE

30% PLANS NOT FOR CONSTRUCTION

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LOUIS BERGER, MORRISTOWN, NJ CADD FILE: G:\Alnggns\everglades old tamiami\drawings revision_1\Plot\TYPICAL SECTIONS 2.dwg Aug 11, 2017

APPENDIX C—HYDROLOGIC ANALYSIS

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Old Tamiami Trail Modifications Hydrology Report

Tamiami Trail - Northwest Shark River Slough Model of Everglades National Park

Hydrologic Modeling Report

August 1, 2017

Kiren Bahm and Kevin Kotun

South Florida Natural Resources Center

Everglades National Park

Homestead, Florida

National Park Service

U.S. Department of the Interior

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1 Introduction

Purpose The hydrologic component of the Old Tamiami Trail Modifications Project will determine how proposed alternatives might facilitate improved deliveries of water from Water Conservation Area 3A into Shark River Slough in Everglades National Park (ENP). The relative benefits of removing increasingly larger sections of the Old Tamiami Trail (OTT) roadbed are examined for wet, average, and dry conditions. The resulting changes in flow capacity of the S12C and S12D structures and the changes in lateral distribution of water flowing into the marsh were evaluated relative to the Base condition.

The project area is shown in Figure 1. The domain of the hydrologic model used in this study is shown in yellow, and extends approximately from Shark Valley to the L67 extension canal. It extends northward to include S12C and S12D, and southward to include the monitoring station NP201.

Figure 1. Old Tamiami Trail area of hydrologic analysis. (Model domain in yellow.)

Background The impoundment of Water Conservation Area 3A (WCA3A) included the abandonment of the original Tamiami Trail roadway in favor of a re-alignment of the road atop the new Levee 29. The L29, completed in 1962, includes four S12 structures: large gated spillways designed to discharge water from WCA3A into Everglades National Park (the Park). Directly downstream of each of the S12 structures, approximately 500 feet of the old roadway was demolished to allow water to move freely from the S12 spillways into

the marsh. The remaining roadway (the Old Tamiami Trail) is a raised roadbed containing several small bridges and culverts along its length, which allow additional pathways for water from the S12s to flow into the park.

Changes to the Central and Southern Florida project resulted in the de-authorization of conveyance features downstream of the S12 structures, and the Old Tamiami Trail road way was left intact. Both of these developments have contributed to a deficiency in discharge capacity from WCA3A. This deficiency has become more acute since the early 1990s when, due to operational changes upstream, more water was directed into the WCAs from the Everglades Agricultural Area resulting in a an increased frequency of undesirably high water levels in WCA3A. The additional conveyance originally planned for the Central and South Florida project downstream of the S12s is not likely to be re-authorized, but many have suggested that removal of the old roadway would help to increase the peak discharge capacity from the S12s and perhaps reduce the duration of high water conditions in WCA3A.

The purpose of this study is to conduct hydraulic model simulations using existing data to evaluate the potential for road removal to improve flow rates through two of the structures, S12C and S12D. Given the availability of relevant data, the question is necessarily specific and focused only on the relative changes in peak flow given a variety of road removal alternatives. The assessment of how the system would respond in WCA3A or in the marsh downstream is beyond the scope of this effort.

Area Description The project area is shown in Figure 1. The canal network is shown in Figure 2 and includes the structures S12C, S12D, Culverts C35 through C39, the L67Ext canal, the Old Tamiami Trail borrow canal, the Tram Road borrow canal and Culvert 5a. Water held in WCA3A to the north passes through the S12 structures when they are open, and then either flows directly south through cutouts in the Old Tamiami Trail, or enters the Old Tamiami Trail borrow canal. Water that entered the canal can then move southward into the Park through several culverts under the Old Tamiami Trail roadbed, or be directed into the Shark Valley Tram Road borrow canal (via Culvert 5a) or into the L67 Extension canal.

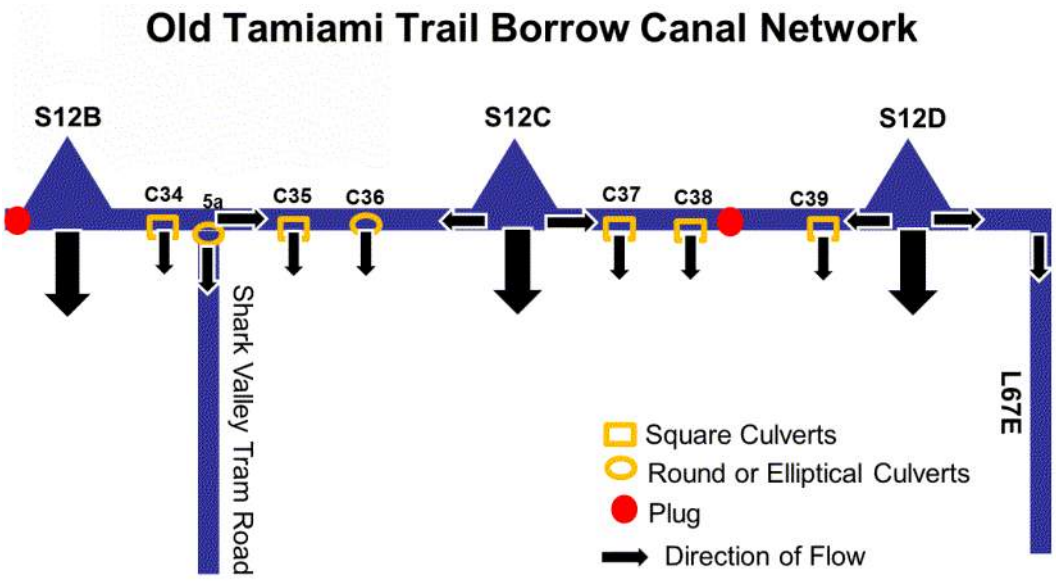

Figure 2. Canal network.

Approach The general approach to the hydrologic modeling component of this project is:

- Collect data on flow rates in the Old Tamiami Trail (OTT) borrow canal and culverts
- Design and calibrate a hydrologic model
- Run the model for each alternative with high, medium, and low stages of WCA3A
- Evaluate the relative changes in flow rate through the S12C and S12D structures
- Evaluate the relative changes in flow rates and stages in the marsh south of the culverts
- Evaluate the lateral distribution of flow in the marsh
- Evaluate the sensitivity of model results to calibration parameters

The details of each of these steps are discussed in the following sections.

2 Available Data and Previous Studies

This section describes the data used in the OTT hydrologic analysis. The datasets are listed with associated details. The last dataset listed was collected specifically for this study, and is documented in detail in the following subsection.

Stage and flow data from DataForEver

- Observed stage and flow data was obtained from the NPS DataForEver database for the period of record
- This data was used in the model for:
  - Establishment of stage relationships between stations
  - Formulation of initial and boundary conditions
  - Establishment of ranges for sensitivity studies

1982 SFNRC Culvert Flows Report (Wagner, Joel I. and Rosendahl, Peter C. (1982))

- Flow measurements along OTT for 20 dates in 1979 and 1980, taken when P33 was between 6 and 7 ft msl.
- Reference: Wagner, Joel I. and Peter C. Rosendahl. 1982. Structure S-12 Water Distribution to Everglades National Park. South Florida Research Center Report T-650. 42pp.
- This data was used in the model for:
  - Calibration of relative flow distributions between the S12 outlets, the culverts, and L67 Extension canal flows
- Caveats: The physical layout of the system at the time this study was completed (1982) is different than today, specifically:
  - Many culverts under the Tram Road are now sandbagged
  - S12F has been removed, the canal was plugged with the installation of the FPL access road across the OTT canal
  - The Old Tamiami Trail borrow canal is now plugged just west of the S12B spillway
  - There is now an open (uncontrolled) connection between the OTT borrow canal and the L67 Extension, parallel to the controlled barrel culverts also connection the two.
  - Elevation and vegetation in the canal profiles are potentially different than the were in 1980

2005-2006 S12D area survey

- OTT borrow canal bottom elevation and cross-section profiles from the FPL access road plug to L67ext, S12D spillway bottom elevations and spillway widths
- Reference: SFWMD Hydrographic/Topographic Survey, Structure-12D Centerline Profile, SFWMD Engineering and Construction Department, Prepared by Sea Systems Corporation. December 2005-January 2006.
- Used in the model for:
  - Establishment of average OTT borrow canal bottom elevation and cross-section profiles

2007 S12D Spillway As-Built survey

- S12D spillway bottom elevations and spillway widths
- Reference: S-12D Spillway Structure Maintenance Dredging As Built, Aalpha Land Surveying Services, Prepared for American Earth Movers, Inc. January-April 2007.
- Used in the model for:
  - S12B, C, and D spillway dimensions
  - Average S12D spillway bottom elevation

2015 OTT roadway survey

- OTT cross-sectional elevations and bridge details in plan and side view
- Reference: Tamiami Trail - Dade County, Florida Topographic Survey. AECOM and Betsy Lindsay Inc. September 2015
- Used in the model for:
  - Estimate of culvert dimensions
  - Southern toe elevations used to derive approximate marsh elevations along the trail (see Figure 3).

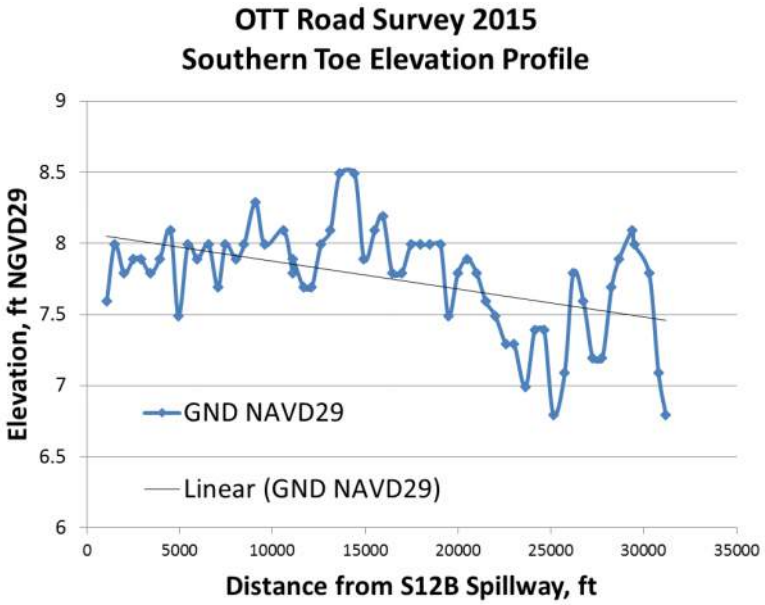

Figure 3. Toe elevations used to derive approximate marsh elevations.

2016 SFNRC Old Tamiami Trail Dataset

- Cross-sectional profiles for OTT borrow canal and for culverts under the OTT. Flow rates for culverts and OTT borrow canal cross-sections.
- Reference: Flow data collected by the South Florida Natural Resources Center staff on October 26th, 2016, combined with observed data from DataForEver. This dataset is discussed in detail in the next subsection.
- Used in the model for: OTT canal and borrow canal topography, culvert dimensions, and model calibration of flow rates and distributions.

2.1 SFNRC Old Tamiami Trail Dataset - October 2016

This section documents the data collection effort by SFNRC staff that obtained depth and flow data to support this project on 10/26/2016. The data were used to characterize the geometry of the model canals and culverts as well as to calibrate the model flow distributions.

This dataset was collected when the S12B, S12C, and S12D structures were fully open. The data were collected using an Acoustic Doppler Current Profiler (ADCP) along 5 cross sections on the Old Tamiami Trail borrow canal. Data were also collected using a wading rod and velocity meter at the 4 square culverts (35, 37, 38, 39) and 2 barrel culverts (5a and 36) passing under the Old Tamiami Trail roadbed. Figure 4 shows the general locations where the measurements were taken.

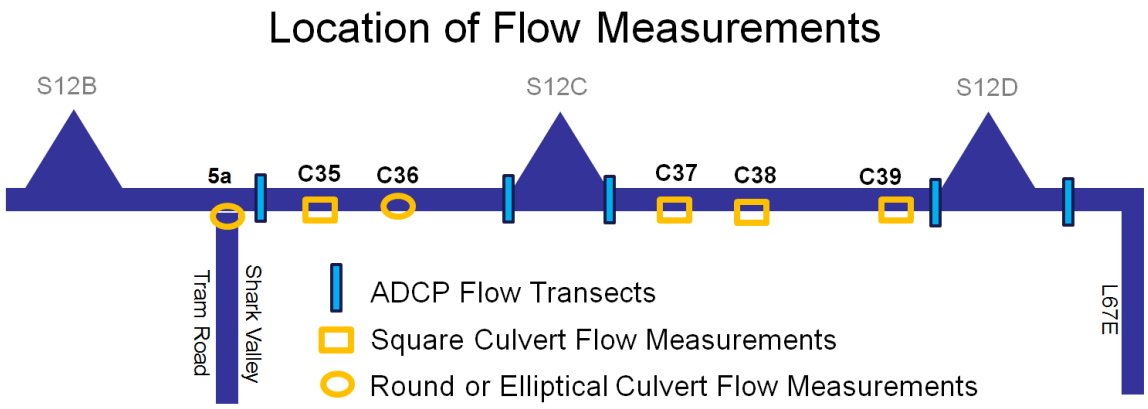

Figure 4. General location map of Old Tamiami Trail flow measurements.

Culvert Dimensions The dimensions of the two unregulated barrel culverts (Culverts 5a and 36) where flow was measured are shown in Table 1. Culvert 5a connects the OTT Borrow Canal to the Shark Valley Tram Road Borrow Canal, and Culvert 36 passes water directly into the marsh west of S12C.

Table 1. Barrel culvert dimensions.

	Width (ft)	Height(ft)
Culvert 5a	3.2	2.75
Culvert 36	6	6

The existing box culverts (35, 37, 38, and 39) are three sided concrete box culverts with earthen floors. Along with Culvert 36, they direct flow from the OTT borrow canal into the marsh. The water depth above the earthen floors of these four culverts was measured along with the flow velocity through the culverts. The elevation profiles of the culverts were then derived by subtracting the measured depth from the S12B, S12C, or S12D tail water stage. These are shown in Figure 5.

Canal Profiles To obtain the geometry of the OTT canal cross-sections where the ADCP measurements were taken, the water depth data were again subtracted from the nearest S12B, S12C and S12D tail water stages to derive the elevation profiles. Figure 6 shows the elevations of the OTT canal profiles derived from the ADCP transect data. The highest

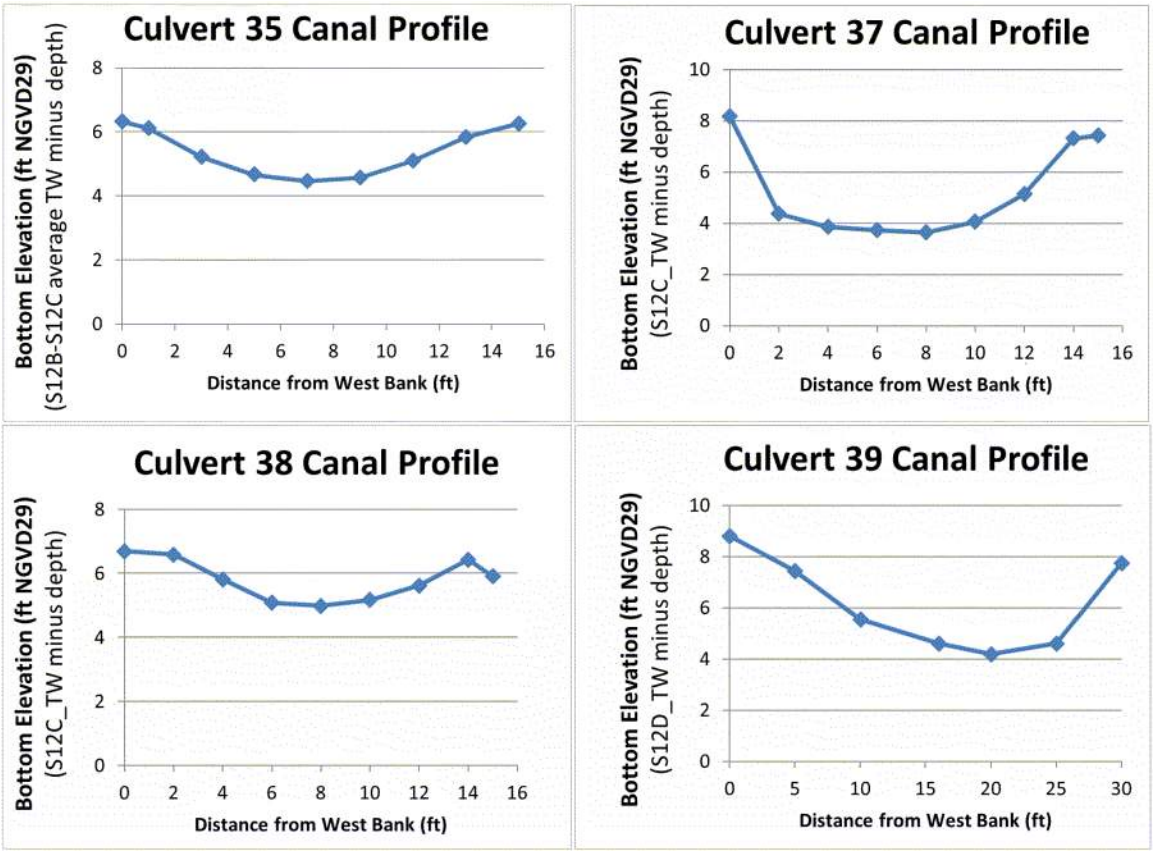

Figure 5. Old Tamiami Trail culvert profiles derived from depth measurements taken on 10/26/2016.

points in each graphic represent the elevation of the bank on each side of the canal, and the lower grouped points are the bottom profiles. There is a gap on each side as the ADCP is not able to measure in shallow-depth areas close to the canal banks.

Flow Measurements Flow measurements are shown in Figure 7. Flows rates across the transects and through the culverts were measured with the ADCP or flow velocity meter, and the S12B, S12C, and S12D flow rates were daily values calculated using data measured by the USGS.

Data in Figure 8 is derived from the ADCP cross-section data, and shows how the flows from the S12s were distributed after leaving the structures. The percentage of the S12 flows that were directed to the east, to the west, or directly southward after passing through the S12 spillways were calculated. Based on the measurements taken on 10/26/2016, 20% of S12C flows entered the OTT borrow canal to the west, 36% entered the canal to the east, and 44% entered the marsh directly to the south. For S12D flows, 13% was directed to the west, 40% to the east, and 47% to the south.

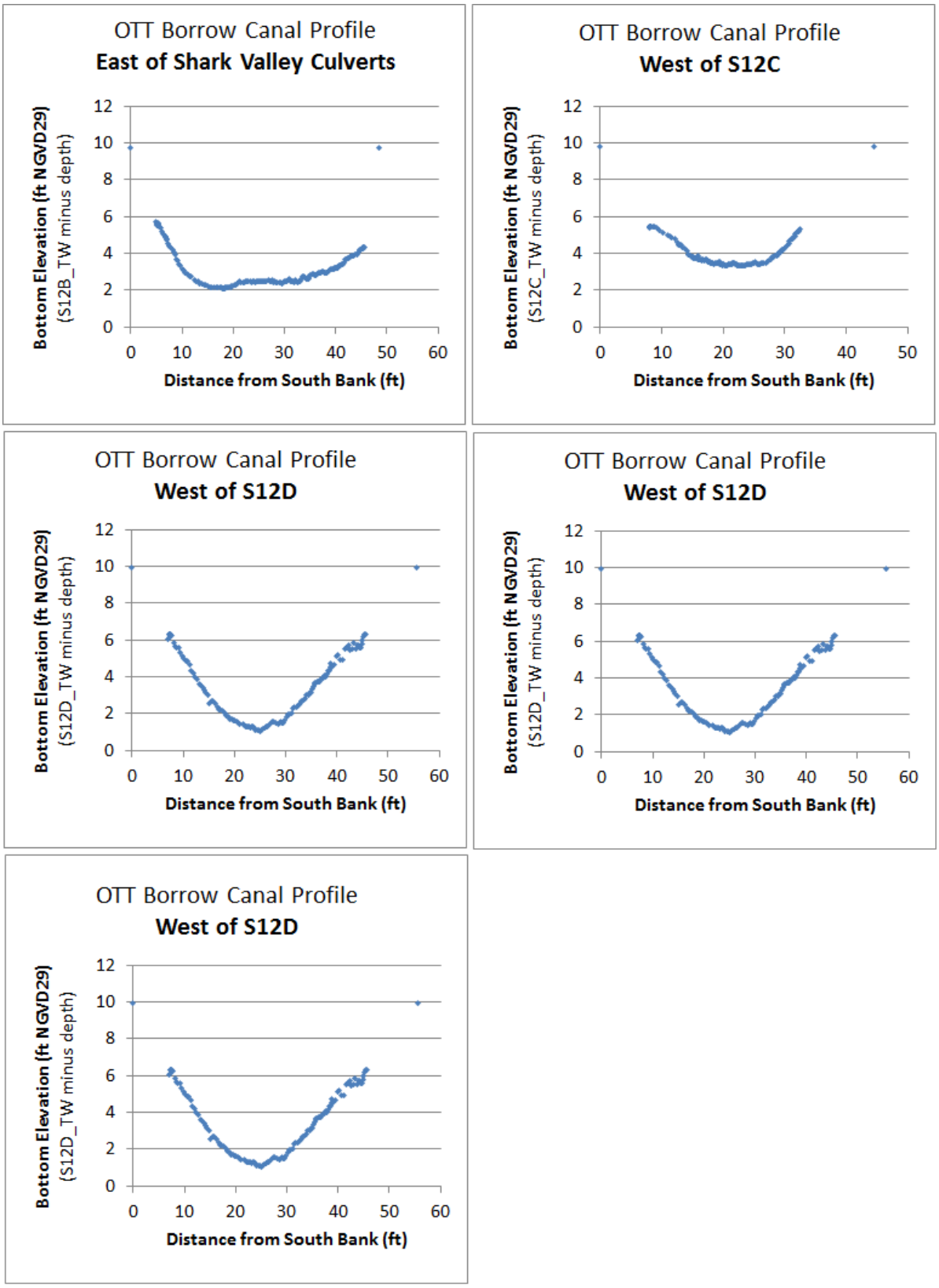

Figure 6. Old Tamiami Trail borrow canal profiles derived from depth measurements taken on 10/26/2016.

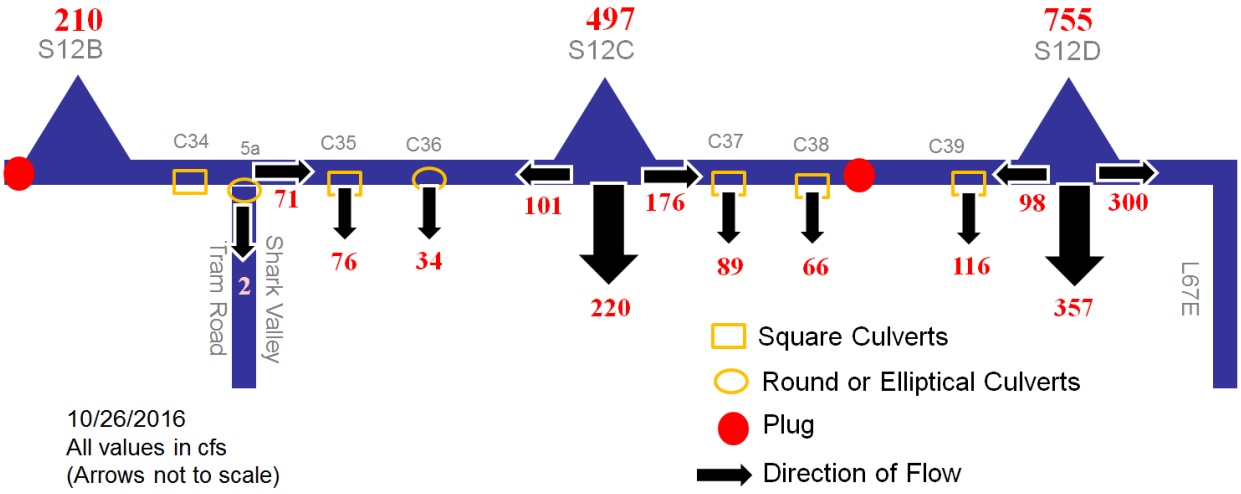

Figure 7. Flow rates measured on October 26, 2016.

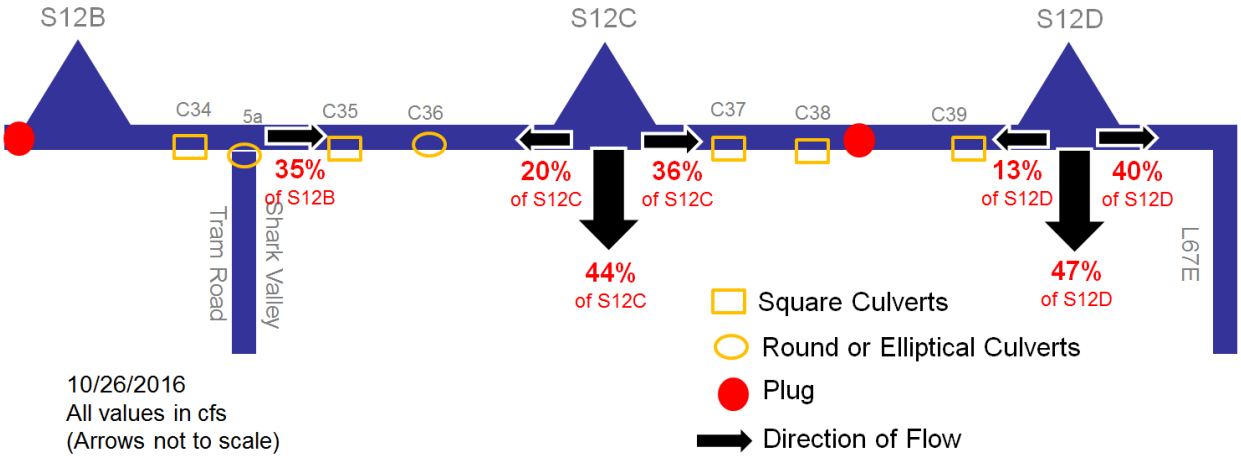

Figure 8. Flow distribution percentages on October 26, 2016.

3 Model Setup

3.1 General Description

To model this area of the Old Tamiami Trail, it is necessary to include several different types of conveyance features as well as their complex interaction. Structural conveyance features discharge to an open channel conveyance, which can flow through other structural features and then into the overland flow associated with the marsh. Open channel flow can also overbank to the overland flow domain and vise-versa. The modeling tool chosen for this study is the MIKE SHE modeling system, primarily for its capability to couple these types of hydraulic structures with open channel and overland flow.

The model developed for this project is the Tamiami Trail - NorthWest Shark River Slough model (TT_NWSRS). It is a 2-dimensional overland flow model coupled with a one-dimensional dynamic open channel flow model. It is derived from the MIKE Marsh Model of Everglades National Park (M3ENP) which was developed specifically for ENP. The M3ENP has over 8 years of development and refinement. A major advantage of these models is the ability to simulate the interaction between the canal system and the marsh.

The model domain was chosen to include the Old Tamiami Trail from just west of S12B to just east of the L67 Extension, as well as a substantial portion of the downstream marsh. The model boundaries were chosen based on natural hydrologic divides created by manmade canals on East, West, and North sides of domain. The southern extent of the domain was chosen to be sufficiently far away so as not to unduly influence model results in the area of interest. Some influence remained, but this was evaluated with the sensitivity analysis and found not to affect the conclusions of the study. Figure 1 shows the extent of the model domain in yellow, along with the location of the S12 structures and Culverts 35 through 39. Shark Valley is just to the east of S12B, and the L67 Extension canal and levee are just to the east of S12D.

The M3ENP model grid was rescaled from a cell size of 400 meters to a cell size of 50 meters square, the topography was updated, and small-scale features of the Old Tamiami Trail roadbed, borrow canal, and culverts were added. Table 2 summarizes the other general parameters used in the model.

3.2 Overland Flow Parameters

Grid Cell Size To allow the smaller-scale features to be represented in the model, a square grid was used with a 50 meter grid cell size. The grid resolution was chosen to allow for several cells to fit between the L29 and OTT borrow canals, while keeping the overall number of cells in the domain at a manageable size.

Separated Flow Areas Separated overland flow areas are used to implement no-flow boundaries such as levees and other features that block surface water flow. There are several features that block overland flow, such as the elevated roadbeds of the Old and new Tamiami trails, the Shark Valley tram road, and the L67 extension levee. To the west, the culverts in the Old Tamiami Trail borrow canal under the road leading to Shark Valley will be plugged as per the Everglades Restoration Transition Plan (ERTP). Flow through the Tram Road culverts is blocked with sandbags. Figure 9 shows each of the areas as a different color.

Table 2. Summary of model parameters.

Parameter	Value
General	
Modules	Overland Flow and Open Channel
MSHE grid cell size	50m
Timestep Control	
Initial timestep	0.5 hr
Overland flow max. timestep	2.0 hr
Increment rate for reduced timestep	0.1
Computational Parameters	
Overland flow Solver type	Explicit
Max courant number	0.8
Threshold depth for OL flow	0.0001 m
Threshold gradient for applying flow reduction	0.00001
Overland - River exchange calculation	Weir formula
Threshold head difference for applying reduction	3
Overland Flow Parameters	
Overland flow Manning Number	$3(m^{(1/3)}/s)$, uniform distribution
Overland flow Detention Storage	5 mm, uniform distribution
Overland flow Initial Water Depth	M03_Initial_Depths-105.dfs2
Separated Overland flow Areas	On
Overland flow Boundary Heads	Same as Initial Conditions
Max Overland flow timestep info threshold fraction	0.01
Topography dataset	South Florida Composite Topography, 2014
Open Channel Flow Parameters	
Timestep	1 min
Initial Water Level	10 ft
Bed Resistance number	Uniform Section, Manning M = 30 $(m^{(1/3)}/s)$
Wave Approximation	High Order Fully Dynamic

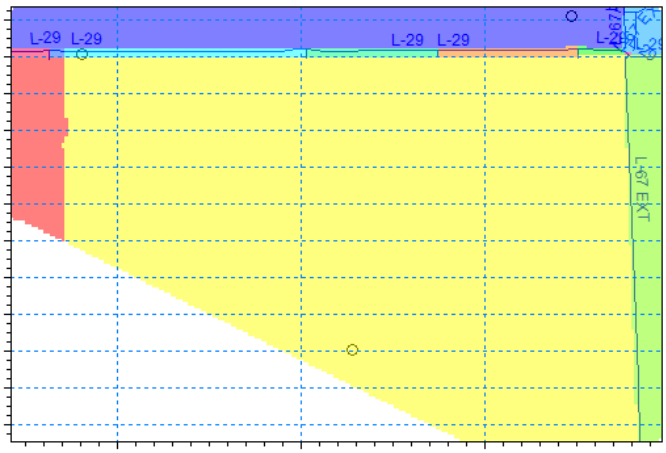

Figure 9. Separated overland flow areas. Each color represents a separate area.

Topography The topography dataset used in the model was derived from the SFWMD South Florida Composite Topography, 50-ft Digital Elevation Model (Rev. 1, 2014). It was upscaled to 50m and converted from the NAVD88 to the NGVD29 vertical datum. See Figure 10.

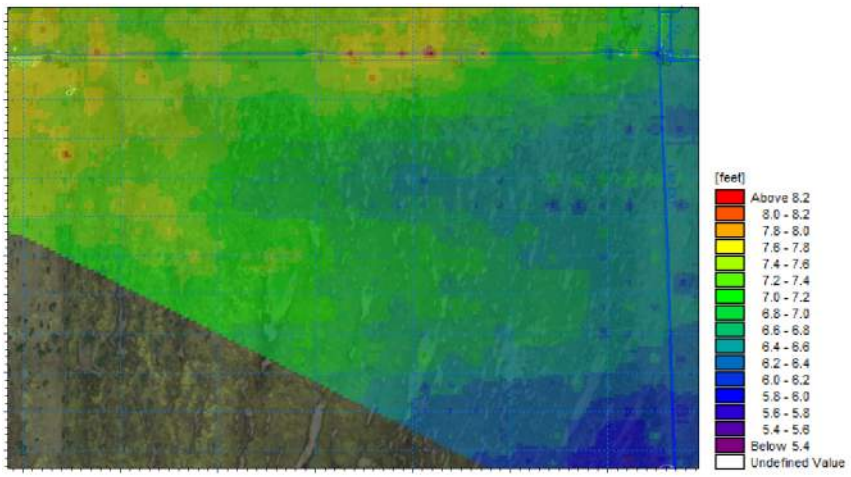

Figure 10. Model topography (NGVD29).

Mannings Coefficient The Mannings coefficient is used to characterize flow resistance due to vegetation and other variations in the land surface, which are collectively referred to as the friction field. Research by Chin (2011) reported Mannings M values in the Everglades from his study and others (Swain et al. (2004), Variano et al. (2009), and Wang et al. (2007)) in the range of 0.47 to 4.35 $m^{(1/3)}/s$. The Mannings value for the overland flow model was chosen to be a uniform value across the model domain at 3 $m^{(1/3)}/s$. Sensitivity studies were performed to see how sensitive the model results were to variations in this parameter. Although model results were found to be sensitive to the Manning's values, changes in this parameter were not found to change the conclusions of this study.

Constant Head Boundary Conditions A constant head boundary condition dataset was created by selecting a historical date with similar stages and flows as when the latest measurements were taken on 10/26/2016. This interpolated stage dataset was run through the TT_NWSRS model without separated overland flow areas, until it reached a steady condition. The separated overland flow areas were then applied and the heads set to zero areas for the North, West, and East sections. The resulting dataset is shown in Figure 11.

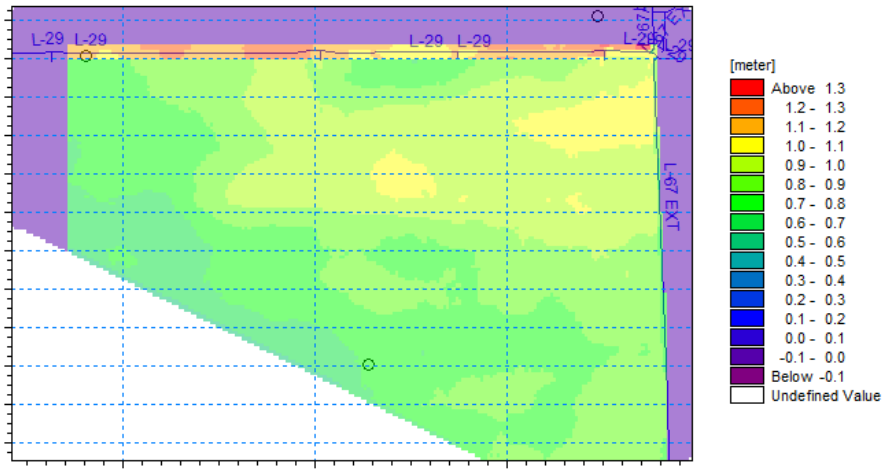

Figure 11. Constant head boundary condition dataset (NGVD29).

3.3 Channel Flow Parameters

The canal network was constructed based on canal and road locations in the Google Earth imagery, measurements collected by the SFNRC, and other recent and historical survey data within in the model area. These data were used to create canal cross-sections, canal bottom elevations, canal volume/cross-sectional area, and bank elevations.

Features in the model include the L29 canal, the OTT borrow canal and roadbed, the L67ext canal, the Tram Road borrow canal and roadbed, S12C, S12D, and Culverts 34-39. The FPL access road blocks flow between Culvert 38 and 39, and there is a plug in the OTT just west of the S12 spillway. The open connection between the OTT borrow canal and the L67 Extension canal is also included. See Figure 2 for general layout of network features.

The S12s were modeled as prescribed discharge for the initial calibration runs and as fully open for the Alternative simulations. For the Alternative run simulations, the S12 structures are each represented in the model by a broad crested weir, with height representing the sill elevation, and width as the combined width of the 6 gates in each structure. The S12 headwater values are the upstream boundary condition applied to the model, and their values are prescribed based on each Alternative. Just downstream of the S12 structures, each S12 spillway is simulated as an open channel that receives water from the structure and either distributes the water to the marsh directly downstream or down the borrow canal associated with the old Tamiami Trail. Water in the borrow canal can overbank to the adjacent land surfaces, flow through the culverts under the old roadbed, or be redirected to another canal extending southward into the marsh. The culverts under the roadbed are represented as either barrel culverts or irregularly shaped weirs.

Table 3 and Table 4 summarize the structure parameters in the model.

Table 3. Culvert and plug parameters.

Culvert Name	Invert (feet)	Length (feet)	No. of Culverts	Section Type	Geometry Type
CULVERT34	3.3	23.5	2	Closed	Rectangular (8x4 feet)
CULVERT35	4.4	22.9	1	Open	Irregular, Level-Width Table
CULVERT36	1.6	23.5	1	Open	Circular, 6 feet
CULVERT37	3.6	25.6	1	Open	Irregular, Level-Width Table
CULVERT38	5.0	25.6	1	Open	Irregular, Level-Width Table
CULVERT39	4.2	24.5	1	Open	Irregular, Level-Width Table
SharkValleyCulverts	3.7	80.0	4	Closed	Circular, 6 feet
TramRoadCulvert	6.5	5.0	1	Closed	Circular, 3.2 feet
SVplug1	3.7	5.0	4	Closed	Circular, 6ft
SVplug2	3.7	5.0	4	Open	Circular, 6ft
TRplug1	6.5	5.0	1	Open	Circular, 3.2 feet

Table 4. Control structure parameters.

Control Structure Name	Type	Number of gates	Calculation Mode	Width (feet)	Sill level (feet)
FPLaccessRoad Plug	Underflow	1	Close	19.0	1.8
S12C_Q	Underflow	1	Fully open	25.7	-10.8
S12D_Q	Underflow	1	Fully open	25.7	-10.8
S12E	Underflow	1	Close	32.8	1.6
S346	Underflow	1	Fully open	38	4.3

Overland and Canal Flow Exchange The overbank spilling option treats the river bank as a weir. When the overland flow water level or the river water level is above the left or right bank elevation, then water will spill across the bank based on the standard weir formula. Numerical problems can occur when the slope of the water surface profile is very shallow and the velocities are very low causing water to form a wall along the bank instead of flowing to neighboring cells as overland flow. The overbank spilling option is used in the open channel model to characterize these shallow ditch/berm systems. To reduce the instabilities, overbank spilling is implemented by extending the canals a short distance into the overland flow domain, which gradually shallow and widen to a width of 1 cell (50 m).

3.4 Model Calibration and Sensitivity

To calibrate the model, the Manning's coefficients in both the Open Channel and Overland Flow domains was adjusted until the flow rates through the culverts and spillways matched the observed data collected on October 26, 2016 for this study. To accomplish this, S12 flow rates were prescribed at the observed values for that day. The Manning's value in the Overland Flow domain (the marsh) was adjusted until the S12C and S12D tail water stage and NP201 stage was close to observed values. Next, the S12C and S12D headwater stage was prescribed and the S12 flows were allowed to vary. The Manning's values in the open channel system were varied until the relative percentages of flow rates were close to observed values.

To determine the sensitivity of the model to input parameters, several different parameters were varied and the resulting changes in flow rates at the S12s was calculated. The parameters tested were:

- Overland boundary condition stages
- Canal boundary condition stages
- Overland topography
- Canal topography
- Culvert size
- Overland detention storage
- Max allowed Overland time step
- Increment for reduced time step length
- Maximum courant number
- Threshold water depth for overland flow
- Threshold gradient for applying low-gradient reduction
- Overland-river exchange weir formula threshold head difference
- Channel Flow time step
- Overland Flow to Channel Flow links chainage range (for culverts)
- Overland Flow to Channel Flow links parameters (weir coefficient)

For those parameters that the model was found to be sensitive to, the Alternative simulations were re-run with variations in these parameters, to determine if uncertainties in the parameters would affect the results of this study. The model results were found to be sensitive to topography, Manning's coefficient in the overland flow domain, and overland boundary condition stages. Effects of these parameters on the simulation results was quantified and is presented in Section 6.

4 Simulations

Simulations were run for five physical configurations, each under wet, average, and dry conditions in WCA3A. The physical configurations were simulated with different configurations of the Open Channel model, labeled Alternative A, C, D1, D2, or E. Wet, average, and dry conditions were defined by average stages in WCA3A, and stage relationships were used to determine appropriate boundary conditions for each of these states.

4.1 Physical Configuration of Alternatives

Five different physical configurations of the Old Tamiami Trail roadbed and underlying culverts were modeled. Alternative A represents the No Action or Base condition, and Alternatives C, D1, D2, and E represent removal of increasing amounts of the roadbed. Alternative E represents removal of the entire length of the roadbed. For the analysis in this project, Alternatives B-E are all evaluated *relative* to Alternative A. The alternatives are depicted in Figure 12.

To aid in interpreting the model results, Table 5 summarizes the length of roadbed removed and the culverts that are present or absent in each alternative.

Table 5. Length of roadbed removed and culverts associated with each alternative.

Alternative Name	Length of Trail Removed	Culvert 35	Culvert 36	Culvert 37	Culvert 38	Culvert 39
Alternative A	0.0 mi.	O	O	O	O	O
Alternative C	1.0 mi.	O	O	O	O	O
Alternative D1	2.5 mi.	O	O	X	O	X
Alternative D2	4.0 mi.	O	X	X	X	X
Alternative E	5.7 mi.	X	X	X	X	X

O = Culvert Present, X = Culvert Absent

The OTT borrow canal is currently plugged at the FPL access road, located just east of C38 (see Figure 2). In the alternatives, a plug also exists between S12B and C35at the Shark Valley Tram Road. Each of the alternatives includes both of these plugs.

4.2 Generation of Wet, Average, and Dry Boundary Conditions

Wet, average, and dry conditions were simulated for each of the alternatives to capture the range of potential responses of the hydrologic system to the proposed modifications. The wet condition was defined as WCA3A 3-gage average stage at 10.5 feet NGVD29, the average condition was defined as WCA3A at 9.5 ft, and the dry condition was at 8.5 ft. These conditions were simulated in the model by changing the upstream and downstream boundary conditions of the model based on observed relationships with WCA3A stage.

Upstream Boundary Conditions To obtain the upstream boundary stages applied as S12 headwater, stage relationships were derived for S12C headwater and S12D headwater corresponding to WCA3A 3-gage average stages of 8.5, 9.5, and 10.5 ft. NGVD29. The stage relationships were established by a linear fit of observed data. Figure 13 shows S12C and S12D headwater vs WCA3A 3-gage average stage. Headwater stages were extracted using a linear fit of observed data to determine the average conditions for S12C and S12D headwater when WCA3A was at 8.5, 9.5, and 10.5 ft. The final values are shown in Table 6.

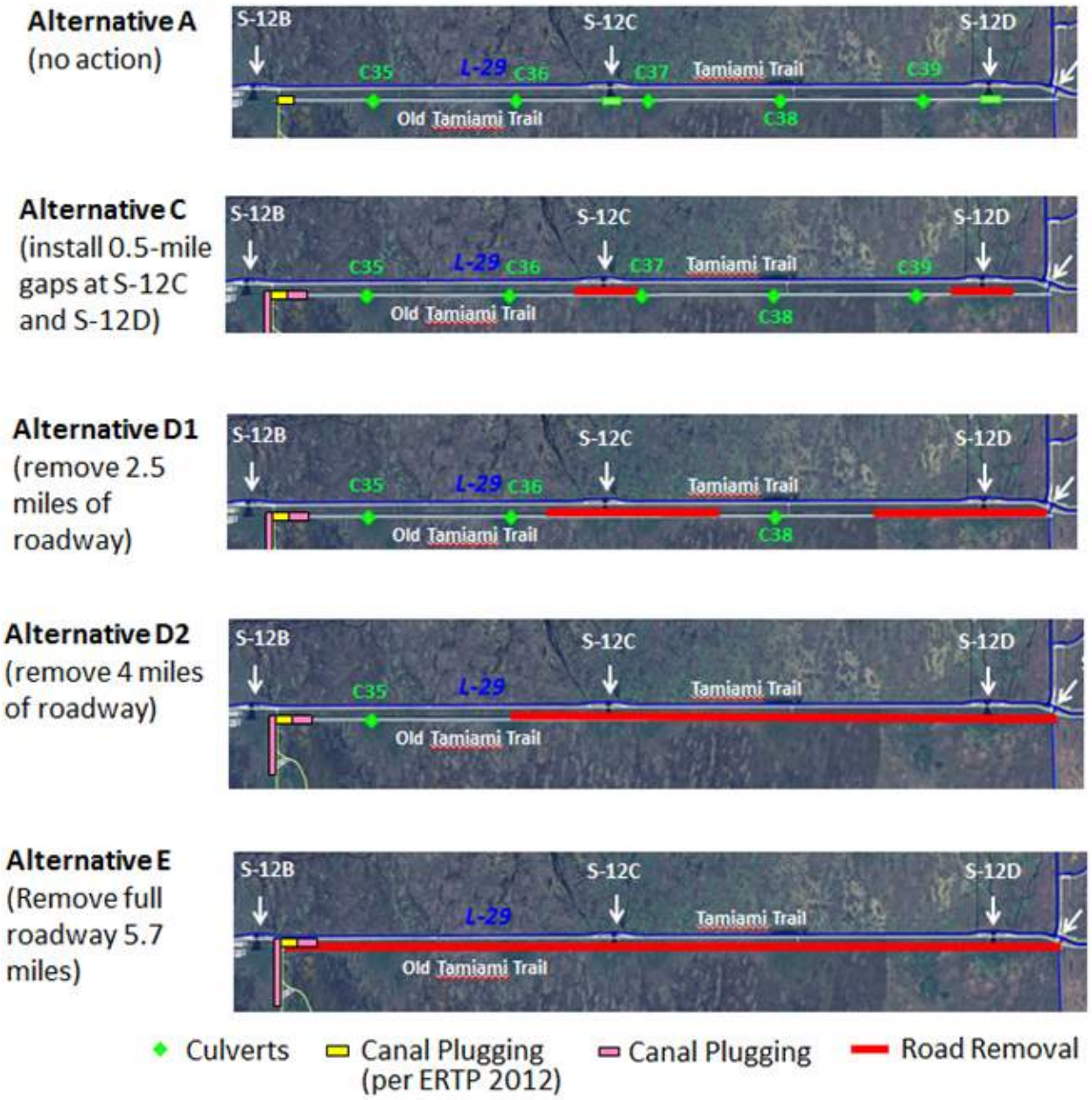

Figure 12. Alternatives for analysis.

Table 6. S12C and S12D headwater and NP201 stage corresponding to WCA3A stages (ft. NGVD29).

WCA3A	S12C_HW	S12C_TW	S12D_HW	NP201	NP201 diff
10.5	9.9	9.9	10.0	8.43	0
9.5	9.1	9.1	9.1	7.83	-0.6
8.5	8.2	8.2	8.1	7.15	-1.3

Downstream Boundary Conditions To create the downstream overland boundary conditions datasets for WCA3A at 8.5, 9.5, and 10.5 ft. a linear fit of observed data was established between S12C tail water and NP201 stage. The location of NP201 is shown in Figure 1. For the simulations in this study, because the S12s are fully open, the S12C headwater and S12C

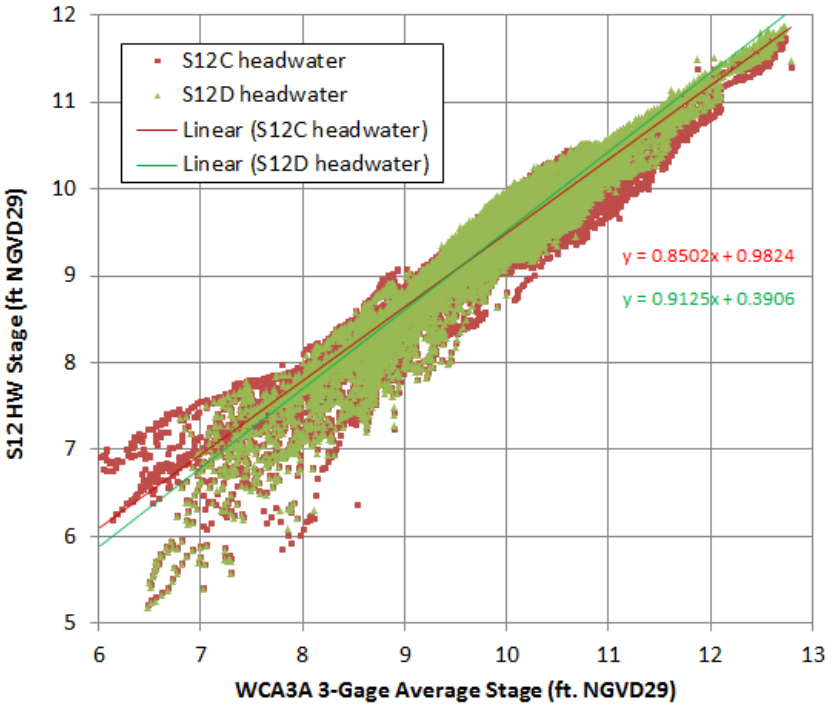

Figure 13. WCA3A average stage vs. S12 headwater.

tail water are always equal. This relationship was used to derive the stage offsets applied for adjusting the base condition constant head boundary datasets for wet, average, and dry conditions.

Data pairs of NP201 stage and S12C tail water stage for each day were extracted from observed data. Data pairs that contained one or more null values were eliminated, as well as data pairs when S12C flow was less than 20cfs. The remaining pairs of data were plotted and a linear fit of this data was used to establish a relationship between S12C tail water and NP201 stage. Figure 14 shows this data. Based on the analysis shown in Figure 14, offsets to apply to the existing downstream boundary condition dataset for 10.5 ft were obtained, and are shown in Table 6.

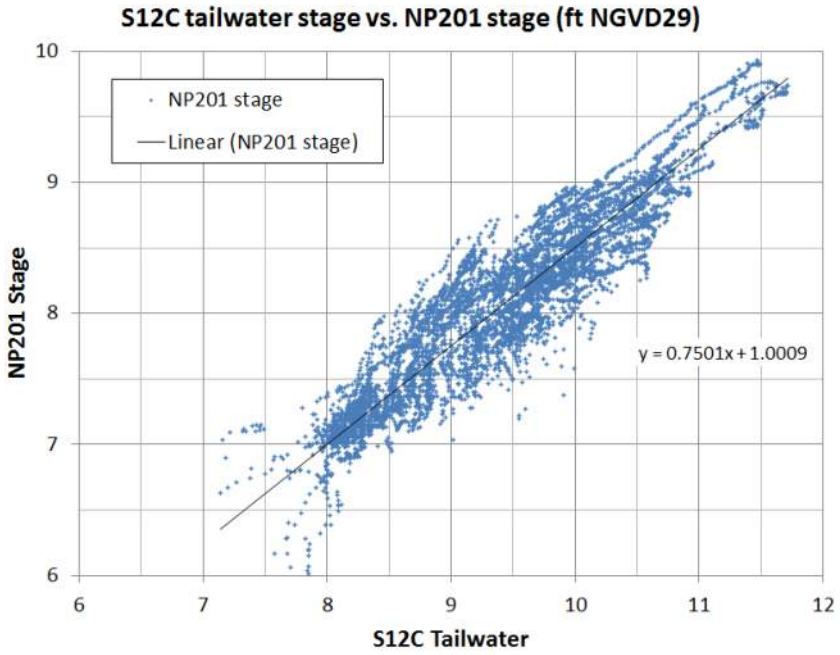

Figure 14. S12C tail water vs. NP201 stage.

5 Results

This section discusses the model results for Alternatives A, C, D1, D2, and E, under wet, average, and dry conditions. Output for flow rates through S12C and S12D were tabulated, and plots were produced of the flow field vectors (with stage) as well as flow magnitudes along a transect south of Old Tamiami Trail. Model sensitivity to input parameters was also investigated and is discussed in Section 6. Model results were evaluated to determine how, relative to the Base condition (Alt A), the proposed alternatives (Alts C, D1, D2, E) changed flow capacity of the S12C and S12D structures and how they changed the lateral distribution of water flowing into the marsh. Results are presented for S12 flow rates, and downstream stage and flow distributions, for wet, average, and dry upstream conditions. The model sensitivity to input parameters was also examined.

5.1 WCA3A Stage Frequency

Model results were analyzed for wet, average, and dry conditions, corresponding to WCA3A stages at 10.5, 9.5, and 8.5 ft NGVD29. To aid in interpretation of the model results, it is helpful to understand the relative frequency that these high or low stages are expected in WCA3A. The WCA3A stage is actively managed throughout the year based on water availability, need for storage, and projected water deliveries to be made downstream. WCA3A stages from 2002 to 2016 are shown in Figure 15, on the left side. The right plot in Figure 15 shows the frequency that the WCA3A stage was at or above a given elevation for each day in the period of 2002-2016.

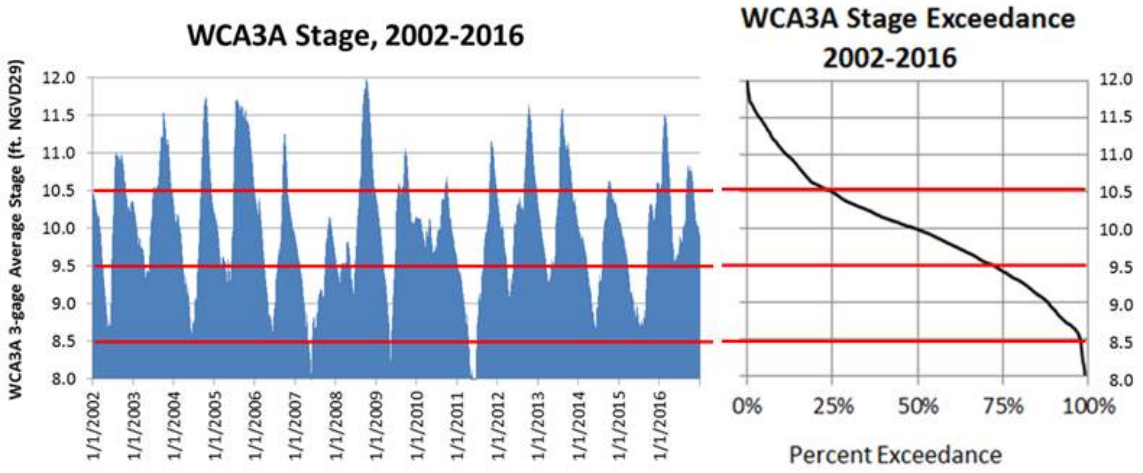

Figure 15. WCA3A stage and stage exceedance.

From Figure 15, it can be seen that the WCA3A stage was at or greater than 10.5 ft for 25% of the time between 2002 and 2016. It can therefore be inferred that the increases in flow rates in the model results for WCA3A stage at 10.5 feet will be present at least a quarter of the time. WCA3A stages are at or above 9.5 ft approximately 70% of the time, and the benefits of each alternative are expected to be at least those shown in the model results for WCA3A at 9.5 feet at least 70% of the time. The WCA3A stage is above 8.5 ft 95% of the time, so the minimum increase in flow shown in the model results can be expected most of the time, assuming the S12 gates are left fully open.

5.2 S12C and S12D Flow Rates

S12C and S12D are the structures that direct water from WCA3A into the area of the Old Tamiami Trail Project. The modeled flow rates through S12C and S12D for each of the alternatives under wet, average, and dry conditions are shown in Figure 16. S12C flow rates are shown in the top three plots and S12D flow rates are in the bottom three plots. The left, center, and right plots in Figure 16 show model results when WCA3A is at 10.5 ft, 9.5 ft, and 8.5 ft., respectively. Each bar represents a different alternative. The percent increase in flow rate over the Base condition (Alternative A) was calculated, and is also shown in the graphics.

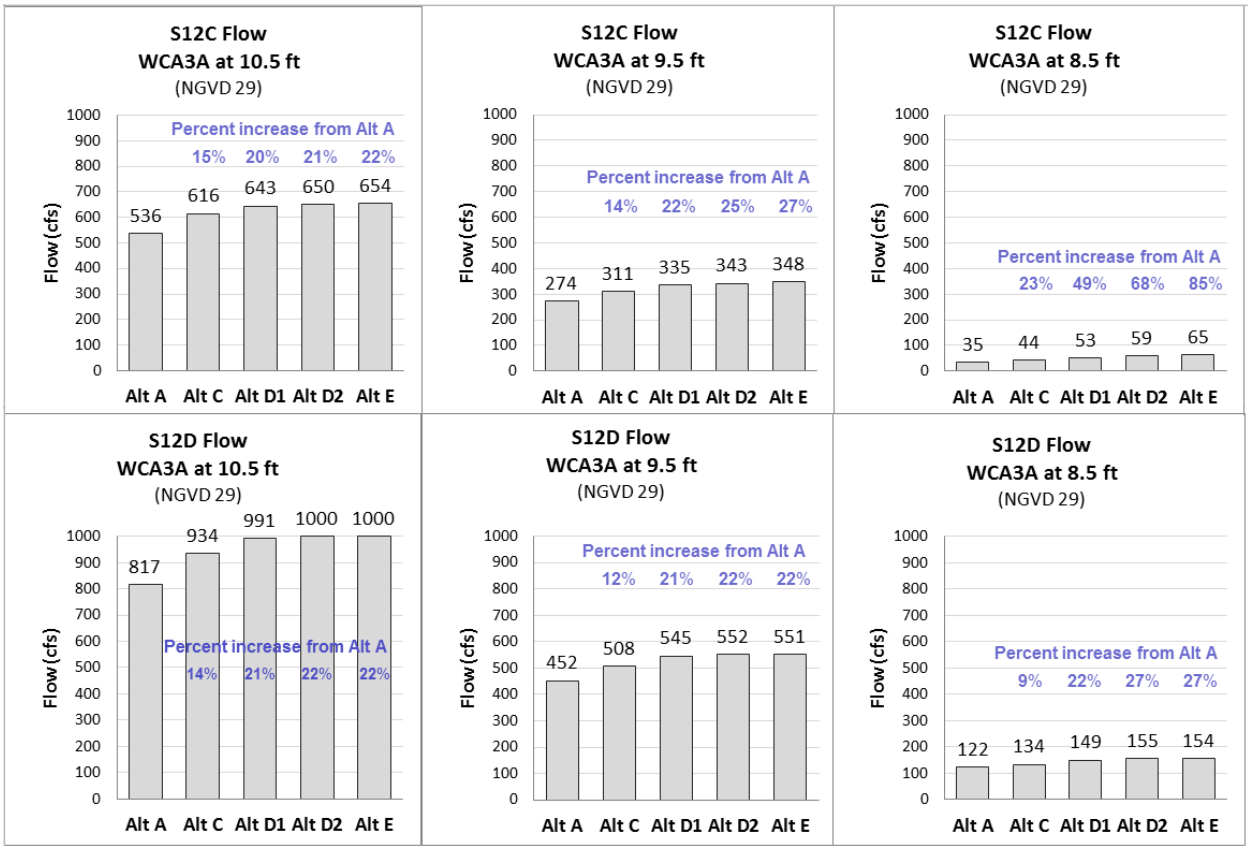

Figure 16. Modeled flow rates through S12C and S12D for each alternative under wet, average, and dry conditions.

In general, S12D flow rates are higher than S12C given the same upstream boundary conditions. As the stages in WCA3A decrease from 10.5 ft to 9.5 ft and 8.5 ft, flow rates through both the S12C and S12D structures decreases substantially.

The model results indicate that removing 1.0 miles of the Old Tamiami Trail roadbed and culverts (Alternative C) will increase flow rates through both the S12C and S12D structures compared to the base condition (Alternative A). As more of the roadbed is removed (Alternatives D1, D2 and E), the rates increase more, with only a slight increase in the flow rate between Alternatives D1, D2, and E.

Table 7 summarizes the plots in Figure 16 by showing the percentage increase in flow rate for the C, D1, D2, and E alternatives compared to Alternative A. As an example, the bar charts above indicate that when WCA3A is at 10.5 ft, S12C flow under Alternative A

is at 536 cfs and under Alternative C it is at 616 cfs. Therefore, Alternative C provides an increase in flow rate of 15% over Alternative A. When WCA3A stage is at 8.5 feet, S12C flow rates are much smaller: 35 cfs in Alternative A and 44 cfs in Alternative C. The relative increase in flow rate in Alternative C compared to Alternative A is 23%. Even though the flow rate at S12C at Alternative C has a greater relative increase over Alternative A at 8.5 ft (23%) than at 10.5 ft (15%), the flow rate is much higher at 10.5 ft (616 cfs) than at 8.5 ft (44 cfs). Similarly, the percent increase of S12C flow rate at 8.5 ft for Alternative E compared to Alternative A is 85%, but that corresponds to a flow rate increase of only 35 to 65 cfs.

Table 7. Percent increase in flow difference between Alternative A and Alternatives C, D1, D2, and E when WCA3A is at high, medium, or low stage.

	S12C Flow			S12D Flow		
WCA3A (ft):	**10.5**	**9.5**	**8.5**	**10.5**	**9.5**	**8.5**
Alt C	15%	14%	23%	14%	12%	9%
Alt D1	20%	22%	49%	21%	21%	22%
Alt D2	21%	25%	68%	22%	22%	27%
Alt E	22%	27%	85%	22%	22%	27%

WCA stage is 3-gage average (ft. NGVD29)

The results shown in Table 7 and Figure 16 indicate the major benefits of increased flow rates from WCA3A into Shark River Slough will come from removing the initial 1.0 or 2.5 miles of roadbed closest to the S12 structure spillways (Alternative C and D1). Higher *relative* increases in flow rates are achieved when WCA3A is at 8.5 ft but correspond to very small rates of flow during dry conditions. Increases in flow rates at the S12s are expected to range from 12%-27% when part or all of the roadbed is removed and the S12s are fully open.

5.3 Stage Distribution in the Marsh

The effect of each Alternative on stage distribution in the marsh was evaluated for an area downstream of the Old Tamiami Trail, shown in Figure 17 with an orange rectangle.

Stage and flow vectors in the rectangular area of the marsh are shown in Figure 18, for each Alternative with WCA3A at 10.5 ft. The colors in the plots represent the stage for each cell in this area, with lower stages shown as darker blue in the southern part of the domain. The stage contours for 8.9 ft and 9.0 ft are noted on the graphics. The arrows on the plots indicate the rate and direction of flow at each cell, with longer arrows indicating higher flow rates.

As expected, flow rates and stages are highest just downstream of the major water delivery structures (S12C and S12D) in all alternatives. The difference in stage between the alternatives can best be visualized by examining the extent of the light blue area in each plot. In Alternative A, the light blue area shows the higher stages are mostly confined to the area around the S12s. As more of the roadbed is removed in Alternatives C, D1, D2, and E, the extent of this area increases, indicating higher stages extending farther into the marsh. Table 8 lists the percentage of area that has a stage at or above 8.9 and 9.0 ft.

Figure 19 shows the percentage of the marsh area cells that are at or below each stage value for each alternative. The median values indicate that the stages in the marsh increase with each increment of roadbed removed.

Figure 17. Location of Stage Distribution results. The orange rectangle delineates the area from which the stage and flow vector results were extracted and analyzed. The yellow polygon depicts the model domain.

Table 8. Stage distribution area percentages for 8.9 and 9.0 ft NGVD29.

	Alt A	Alt C	Alt D1	Alt D2	Alt E
8.9 ft. or above	25%	63%	78%	78%	82%
9.0 ft. or above	2%	8%	10%	10%	10%

Figure 20 shows modeled stage and flow vectors for Alternative A and Alternative E under dry conditions, when WCA3A stage is at 8.5 ft. NGVD29. Although stages are lower in these two plots, Alternative E is still shown to have higher stages overall compared to Alternative A.

In general, Alternative A has the lowest stages and Alternative E has the highest stages. As more of the Old Tamiami Trail is removed, the uniform sheet flow across the downstream area is increased.

5.4 Flow Distribution Entering the Marsh

To evaluate changes in the lateral distribution of water deliveries to the marsh due to different alternative implementations, flow rates were extracted along a transect extending in the East-West direction, south of the culverts. The location of the transect is shown in Figure 21 with a blue line.

Figure 22 shows predicted flow rates perpendicular to the transect line in the map above for Alternatives A - E at WCA3A stages for wet, average, and dry conditions. The elevations of the cells in the model along this transect line are shown in Figure 22. The overall effect of the topography on the the flow rates is shown, with higher flow rates occurring where the topography is lower and the water depth is greater. As expected, lower WCA3A stages result in lower north-to-south gradients and therefore lower flow rates through the S12s. Flow rates with WCA3A at 8.5 feet also do not show pronounced variability between alternatives. The preferential flow paths through the culverts and S12s can be seen in the variability of flow rates along each transect.

The flow rates in the Alternative E transect illustrate the improvement in the lateral distribution of flow with the removal of the trail, as well as higher overall flow rates. The

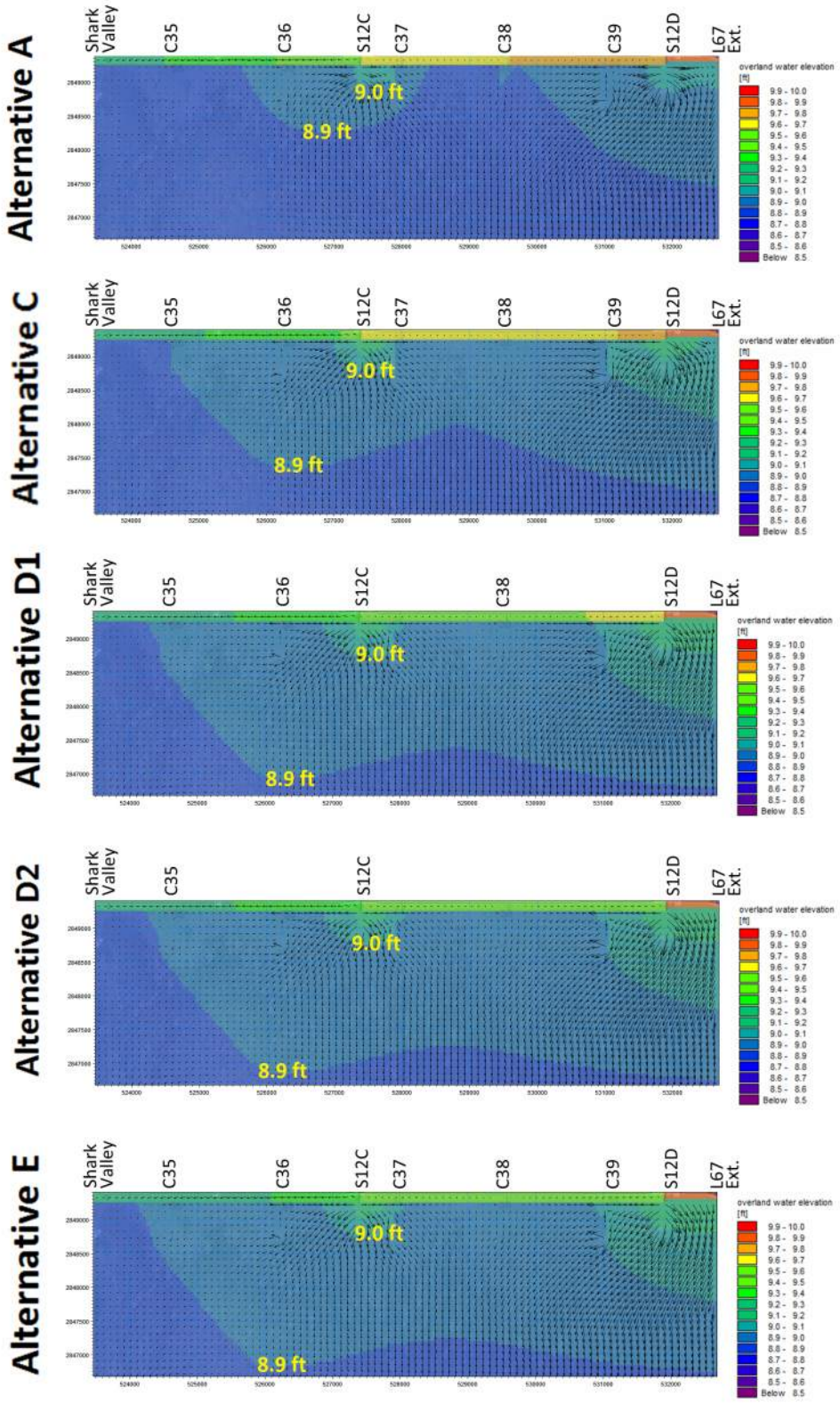

Figure 18. Stages (represented by colors) and flow vectors (represented by arrows) for alternatives under wet conditions for each Alternative. The 8.9 and 9.0 ft stage contours are noted in the graphics. All values are in ft. NGVD29.

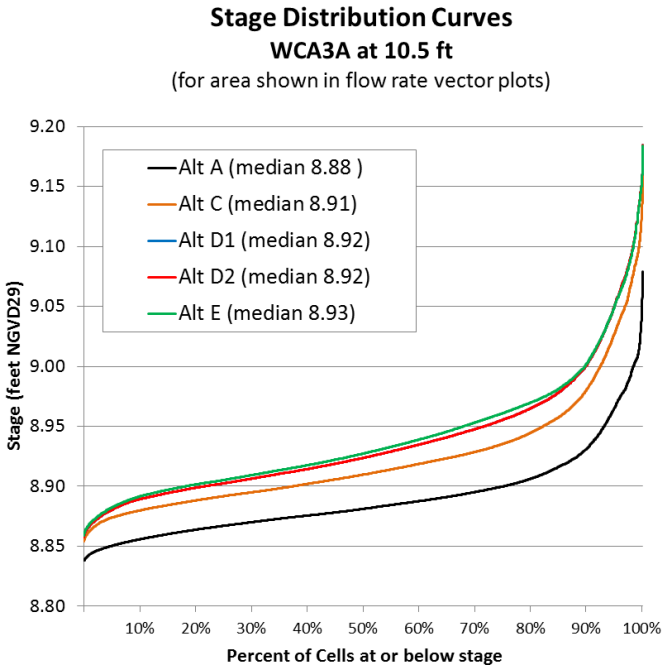

Figure 19. Stage distribution curves and statistics for the marsh under wet conditions. This plot summarizes the percent of cells from the Figure 18 that are at or below a given stage for each Alternative.

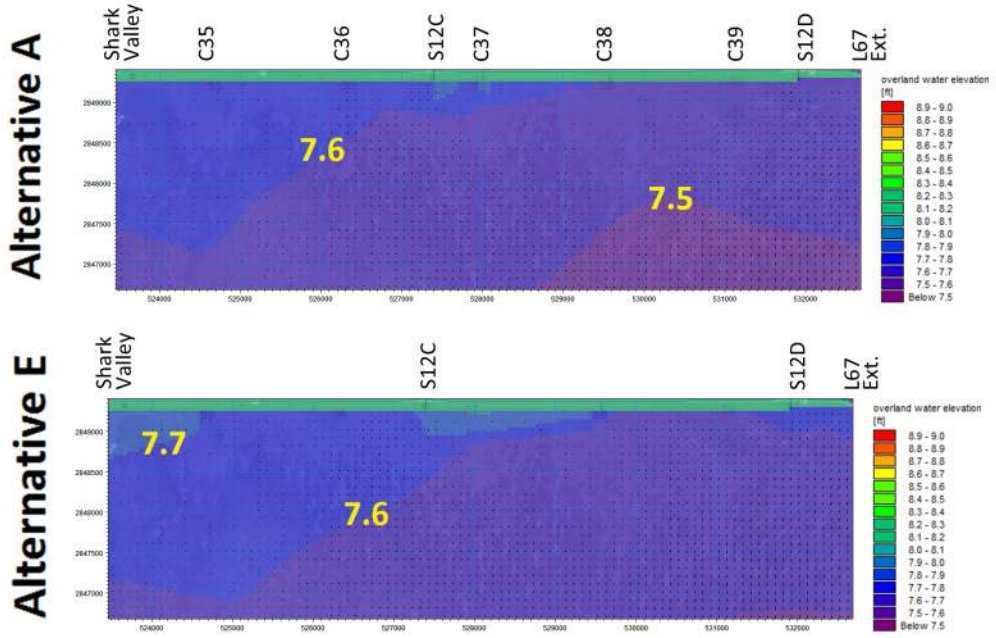

Figure 20. Stages and flow vectors for Alternatives A and E under dry conditions (WCA3A at 8.5 ft NGVD29)

Figure 21. Location of the transect along which flow rates were extracted and analyzed.

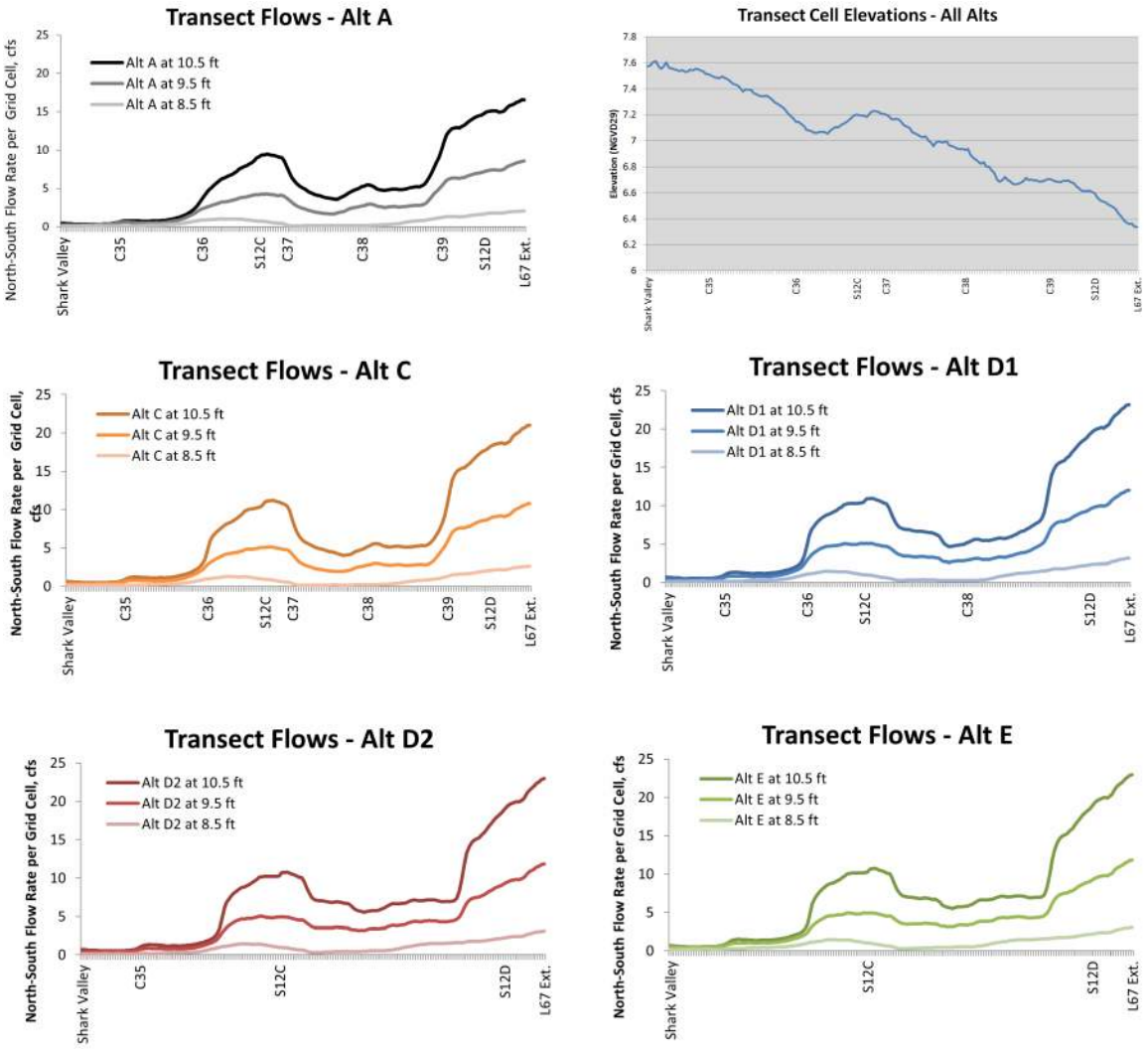

Figure 22. Flow rates across cells in the transect shown in Figure 21 for Alternatives A, C, D1, D2, and E. The three lines in each plot are results under wet, average, or dry conditions. The top right plot shows the land surface elevations along the same transect. The x-axis gives the locations of Shark Valley, the S12s, and the L67 Extension along the transect. The culverts present in each alternative are also noted.

small flow rates seen in the vicinity of Shark Valley in the alternatives indicate that once the Shark Valley plugs are in place (part of the Base Condition) minimal flow will be directed eastward of Culvert 35. The flow rates generally increase from west to east, which reflects the topography along this transect (the elevation profile is lowest in the east and highest in the west).

Even though the entire trail is removed in Alternative E, the flow rates in Figure 22 are still heavily dominated by S12C, S12D, and the L67 Extension. The L67 Extension canal also exhibits a large influence on flow rates by providing a conveyance channel for water to flow towards the lowest elevations in the slough to the south.

Figure 23 shows the distribution of flow rates in each cell of the OTT transects for each alternative under wet conditions. Each box represents one alternative. The distribution of the data for the cells along the transect are shown for each alternative, and the median flow rates for each set are shown below the alternative names.

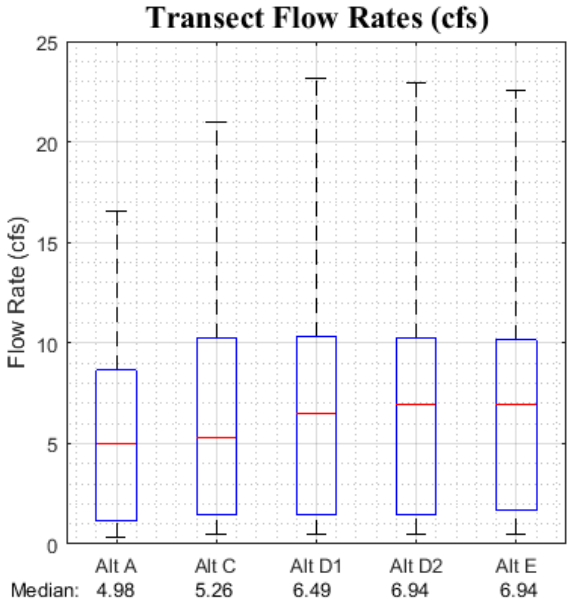

Figure 23. Flow distribution summary statistics for wet conditions (WCA3A at 10.5 ft).

Figure 23 illustrates how the median flow rate is lowest in Alternative A, and highest in Alternatives D2 and E. The interquartile range is smallest in Alternative A, which indicates that the flow rates are more evenly distributed along the transect; however the magnitude of flow is also the smallest. Alternative E has the next smallest interquartile range, and the most evenly distributed flow of Alternatives C through E.

6 Sensitivity of Results to Model Inputs

The goal of this study is to weigh the *relative* benefits of Alternatives C, D1, D2, and E compared to Alternative A. The sensitivity of the model is therefore only relevant to this analysis if it changes the relative differences between predicted flow rates in the alternatives. If the model sensitivity affects all alternatives in the same way the parameter is deemed to not have an influence on the conclusions of this study because the *relative* changes will be the same. For example, if the model predicts flows at S12C that are 10 cfs too high in all alternatives when a given calibration parameter is varied, the parameter is not significant to the study results. If the model predicts S12C flows are 10 cfs higher only in Alternative E and not in Alternative A, the unknowns in this parameter are important to account for in the results and subsequent conclusions of this study.

Sensitivity of the model to several factors was quantified by varying each model input parameter, and examining the changes in S12C and S12D flow rates for Alternatives A and E. Parameters tested included boundary condition stages, Mannings coefficient for the marsh and for the canals, canal depth, canal width, and the model parameters of minimum flow area for overbank spilling and weir coefficient of canal banks. Changes in the model results were found to be negligible for all parameters with the exception of the Mannings coefficient in the marsh and the southern boundary condition stages. Discussion of these two parameters follows.

6.1 Sensitivity to Changes in Downstream Boundary Conditions

The boundary condition refers to the prescribed stages along the perimeter of the model domain. The model sensitivity is primarily to the prescribed stages in the southern edge of the model domain. These stages were varied to quantify how assumptions regarding predicted stage in this area might affect the conclusions derived from the model results. The relationship between S12C tail water and NP201 stage was used to derive the amount of variation that can reasonably be expected in boundary condition stages for this model application. This is discussed in more detail in Section 4.2. The ranges of NP201 stage for S12C tail water were extracted from the observed data. For a given S12C tail water stage, the NP201 stage will follow the relation $NP201\_stage = 0.75 * S12C\_TW + 1.0$, with a maximum average error of +0.6 ft or -0.4 ft.

The model alternatives were run with downstream head boundary conditions 0.6 ft. higher and with downstream boundary conditions 0.4 ft. lower. The results are shown in Figure 24. These results indicate that the boundary conditions can influence the predicted flow rates by a significant amount for all alternatives. The lower flow rates decrease substantially when the southern boundary condition is higher and therefore the north-south stage gradient across the model domain is lower. Decreasing the downstream boundary stages will increase the north-south stage gradient, but the effect on the flow rates through the S12s is not as large. The important result to note, however, is that the relative performance of the Alternatives with respect to each other does not change as a result of the change in downstream boundary condition. Therefore the results of the study are determined to be the same, even with the inherent uncertainty in downstream conditions.

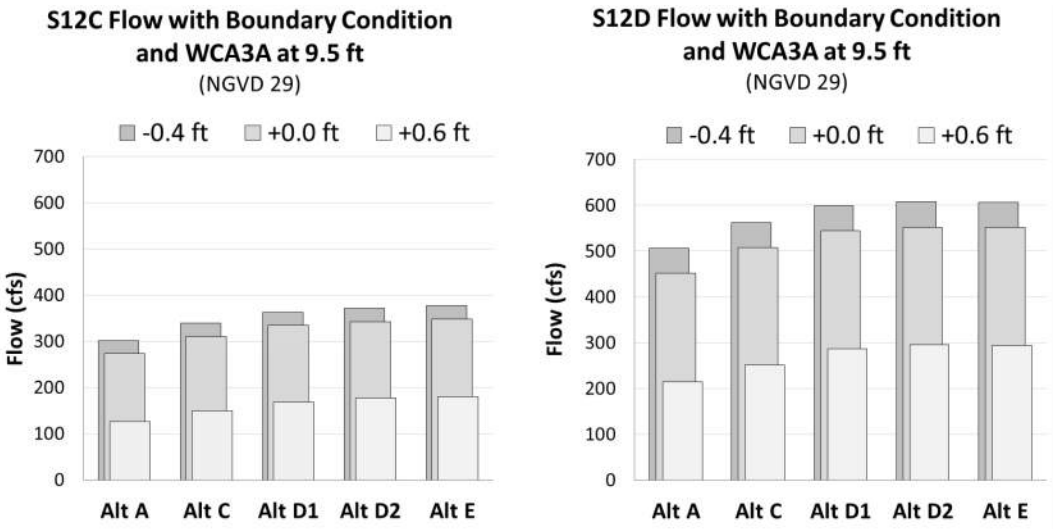

Figure 24. Sensitivity of flow rates to prescribed downstream boundary stages under normal conditions (WCA3A is at 9.5 ft.). Flow rates are given for S12C (left) and S12D (right) for each of the 5 Alternatives. The overlapping bars show the sensitivity of the calculated flow rates to changes in the downstream boundary stage. The center bar in each set of 3 is the base condition. The lighter bars in front are for boundary stages 0.6 ft higher than the base run. The darker bars in the back are for boundary stages 0.4 ft lower than the baser run. Although the flow rates differ when the boundary stages are changed, the relative benefits between each of the Alternatives retains the same ascending pattern.

6.2 Sensitivity to Changes in Mannings Coefficient

Manning's M is a coefficient used to quantify the friction field in the overland flow domain. It is a calibration parameter and was set to a value of 2 $m^{(1/3)}/s$ in the model. To determine the sensitivity of the model results to this parameter Alternatives A and E were run with Mannings M values of 2, 3, and 4 $m^{(1/3)}/s$ in the overland flow domain. The percent change in S12C and S12D flow rates between Alt A and Alt E for the different Mannings M values are shown in Table 9.

Table 9. Percent increase in flow rate between Alternative E and Alternative A, given different values of Manning's M. Values are given for wet conditions, and Manning's values are in $m^{(1/3)}/s$. Values in parentheses are the percent difference from the base condition shown in the middle row of the table.

	S12C Flow	S12D Flow
Mannings M = 2	20% (-2%)	20% (-2%)
Mannings M = 3 (base)	22%	22%
Mannings M = 4	23% (1%)	24% (2%)

Although changing the Manning's M value from 3 to 2 or from 3 to 4 $m^{(1/3)}/s$ changed the flow rates passing through the S12 structures, the relative change in flows between alternatives remained less than 2%. This indicates that any uncertainty in the friction field calibration parameter will not change the conclusions of this study.

7 Summary and Conclusions

The hydrologic analysis for the Old Tamiami Trail Modifications Project determined that the proposed removal of the OTT roadbed will result in an increase in flow rates at the S12C and S12D structures, increased stages south of the road, and increased flow rates into the marsh. As more of the roadbed is removed, the resulting benefits will increase. The relationship between how much of the roadbed is removed and the magnitude of benefits is not linear, however. The largest increases in flow rates and stages are seen when the roadbed nearest the S12C and S12D spillways is removed.

Hydrologic benefits were determined through the use of a coupled overland flow - open channel hydrologic model, developed and calibrated specifically for this analysis. Data to assist in model calibration were collected and used to calibrate the modeled flow distributions in the Old Tamiami Trail (OTT) borrow canal and culverts. Other relevant datasets were used to parameterize and calibrate the model.

The five Alternatives proposed for this project were run under wet, average, and dry conditions, defined through high, medium, and low stages in WCA3A. The first alternative, Alternative A, represented the 'without project' condition. Benefits from the other four Alternatives were evaluated relative to Alternative A. The other four alternatives - C, D1, D2, and E - represented increasingly large portions of the roadbed being removed. Alternative E represented full removal of the Old Tamiami Trail roadbed.

Model results were evaluated to determine the effects of each alternative on flow rates through the S12 structures, flow rates in the marsh, and stages in the marsh. The alternatives were also run with changes in the boundary stages and Manning's friction coefficient to evaluate sensitivity of the model to these calibration parameters.

Results indicated that flow rates at S12C and S12D will increase as more roadway was removed. The largest hydrologic benefits are achieved with full removal of the Old Tamiami Trail roadbed. The percentage of benefits achieved by Alternatives C, D1, D2, and E compared to Alternative A increases with increased removal of the OTT.

The largest hydrologic benefits of increasing flow at S12C and S12D will come from removing the initial 1.0 or 2.5 miles of roadbed closest to the S12 structure spillways (Alternatives C and D1). Removing more of the roadbed will increase flow rates at the S12s as well, but with decreasing magnitude. Removing 1.0 miles of roadbed (Alternative C) is expected to increase flow rates 12-15% when WCA3A is above 9.5 ft. NGVD29, and the S12C and S12D structures are fully open. Removing 2.5 miles of roadbed (Alternative D1) will increase flow rates 20-22% under similar conditions. Removing more of the roadbed (Alternatives D2 and E) will increase flow rates 22-27%. Stages in the marsh increased slightly as more roadway was removed, on the order of a tenth of a foot under the wettest conditions with the S12s fully open. Flow rates in the marsh were also higher and more distributed as more roadway was removed.

Model results were found to be sensitive to some input parameters such as downstream stage, but these parameters did not change the relative benefits calculated for Alternatives C, D1, D2, and E, and therefore did not change the conclusions of this study.

LITERATURE CITED

Chin, D. A. (2011). Hydraulic Resistance versus Flow Depth in Everglades Hardwood Halos. *Wetlands* **31**, 989–1002. DOI 10.1007/s13157-011-0214-3.

Swain, E., Wolfert, M., Bales, J. and Goodwin, C. (2004). Two-dimensional hydrodynamic simulation of surface-water flow and transport to Florida Bay through the Southern Inland and Coastal Systems (SICS). Water-Resources Investigations Report 03-4287, United States Geological Survey.

Variano, E., Ho, D., Engel, V., Schmieder, P. and Reid, M. (2009). Flow and mixing dynamics in a patterned wetland: Kilometer-scale tracer releases in the Everglades. *Water Resources Research* **45**, 1–11.

Wagner, Joel I. and Rosendahl, Peter C. (1982). Structure S-12 Water Distribution to Everglades National Park. Technical Report SFNRC T-650, South Florida Natural Resources Center, Homestead, FL.

Wang, J., Swain, E., Wolfert, M., Langevin, C., James, D. and Telis, P. (2007). Salinity, and Surface-Water Stage in the Southern Everglades, Florida. Scientific Investigations Report 2007-5010, United States Geological Survey.

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EVER 160 139826 December 2017

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