Design Considerations for RV Parks and Campgrounds

NOWRA

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By

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- The materials being presented represent my own opinions, and do NOT reflect the opinions of NOWRA.



Causes of Growth of RV Parks

- Popular Trend
- Large Number of New Retirees
- Remote Work
- Traveling Workers
- Affordable Travel Option
- Affordable Housing

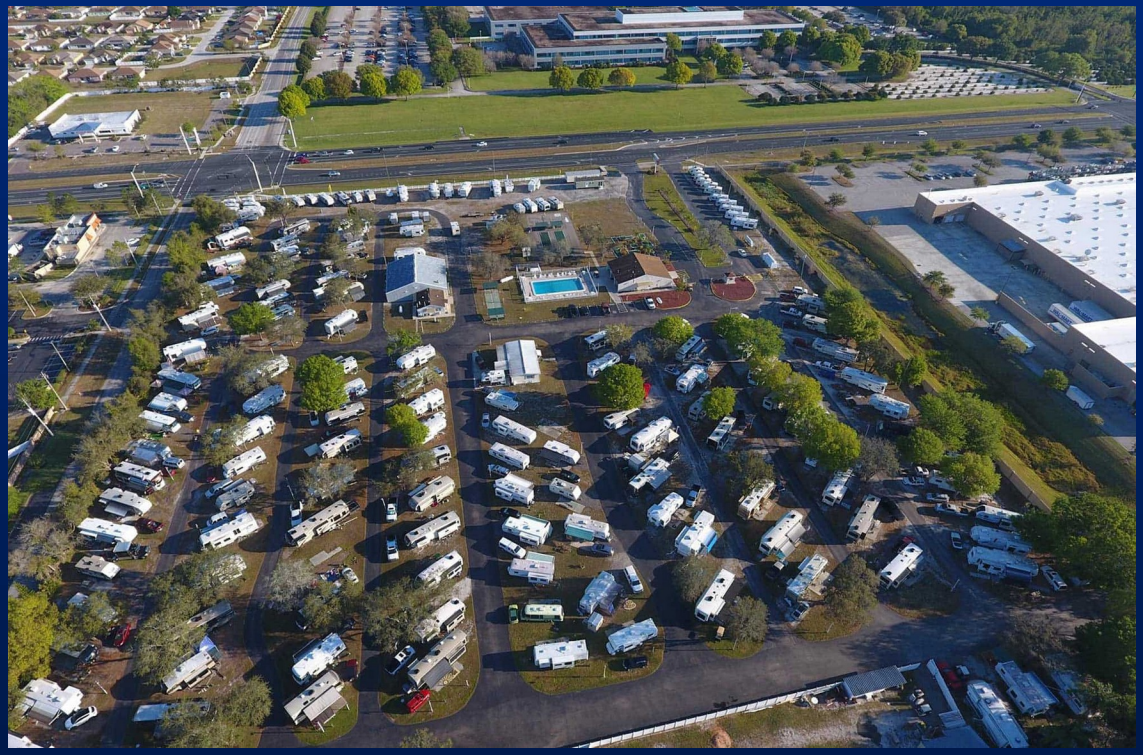
Types of RV Parks

- Destination Parks (RV Resorts)
  - Located Near Potential Attractions
  - Feature Amenities Such as Pools, Playgrounds, Water, Etc.



Types of RV Parks

- Transient Parks
  - Located Along Highways
  - Caters to Travelers, Often Short Term



Types of RV Parks

- Extended Stay Parks
  - Cater to Long Term Clients
  - Can Feature Washing Machines, Dryers, Bathhouse, ETC



Main RV Park Customers

- Traditional RVs



- Park Models



- All RVs Are Not Created Equal

Wastewater DDF Flows (NC)

- Traditional RV Models: 100 GPD/Space
- Park Models (≤ 400 SF): 150 GPD/Space
- Tiny Homes (≤ 400 SF): 175 GPD/Dwelling or 120/BR
- Custom Storage and RV Park: 100 GPD/Space ?
- Glamping: ?
- Bathhouse with No Hook Ups: 70 GPD/Space
- Primitive Camping: Varies by Provisions
- Employees: 12 Gal./8 Hr. Shift plus 2 Gal./Hr.
- Amenities: Food Service, Marinas, Day Use Pool, Etc.




Jagermeister
BUSCH LIGHT
805
USA
FIREBALL


RIVERSTONE
LEGACY
RAM





Wastewater Strength From RVs

- RVs Utilize Low Flow Features
  - Provide Water Savings for Limited Water Storage
  - For Example, Toilet Flushing Volume can be 0.5 GPF
  - Low Flow Toilets are 1.28 GPF

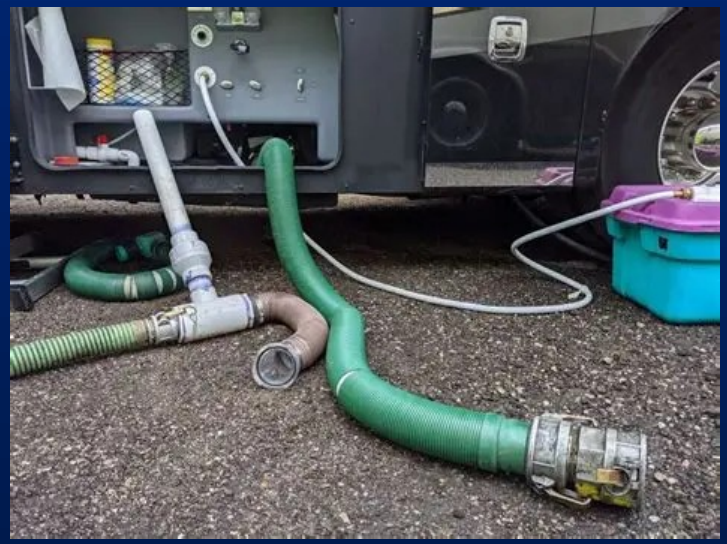


- Useful For Travelling with No Connections, However….

Wastewater Strength From RVs

- Due to the Low Amount of Water Used Relative to Waste, Wastewater is Qualified as High-Strength

- This Presents Additional Challenges



Wastewater Strength From RVs

- Typical Domestic Wastewater has a Biological Oxygen Demand (BOD) of ~250 mg/L
- Maximum DSE Wastewater has a BOD of 350 mg/L
- RV Wastewater can exceed a BOD of 1,000 mg/L

RV “Black Tank” Chemical Treatments

- RVs Historically Use Strong Chemicals in Their Waste Tank to Reduce Smell
  - Contains Dangerous Chemicals Such As Formaldehyde, Bronopol, and Zinc Sulfate Monohydrate
  - May Do A Good Job of Reducing Smells, but Can Cause Serious Harm to Helpful Bacteria in Septic System



Alternative Chemical Treatments

- Other Cleaning Chemicals Exist That Can Suppress Smells Without Killing Bacteria
  - Organic Options Function Similar to A Septic Tank, but are More Costly
  - Does Not Contain Chemicals that Harm Septic System

Overcoming Wastewater Strength

- Two Main Options are Available for Disposing of High Strength RV Wastewater (NC)
  - Limiting System Size to 1,500 GPD or Less
  - Constructing Advanced Pretreatment

Limiting System Size

- A Traditional System Can be Used with RV Parks as Long as It Does Not Exceed 1,500 GPD. However…
  - System Cannot Utilize a Collection Sewer
  - No Innovative Product Reductions, Flow Reductions, or LTAR Adjustments
  - Setbacks between Systems take up Space

- This Method is Suitable for Small Parks, but Concerns with Multiple 1,500 GPD Systems and Private Options

Advanced Pretreatment

- Advanced Pretreatment can Be Used to Bring High Strength Effluent to Domestic Levels
  - Enables Collection Sewers
  - Enables Use of Provisional, Innovative, and Accepted Product Dispersal Field Reductions
- Increased Treatment Standards Protect System From Costly Failures, Extends Lifespan of Drainfields

Standards NSF / ANSI

Test	NSF/ANSI 40	NSF/ANSI 245	NSF/ANSI 350
	Domestic	Nutrient	Reuse
CBOD 5-Day	25 mg/l	25 mg/l	10 mg/l
TSS	30 mg/l	30 mg/l	10 mg/l
Nitrogen Reduction		50 % Reduction	
Turbidity			5 NTU
Bacteria (e-coli)			14 CFU/100ml
Chlorine Residual			0.5 - 2.5 mg/l
pH	6 - 9		6 - 9

Additional On-Site Wastewater System Protection

- Dump Stations Can Be Installed, Encourages Proper Disposal of Large Amounts of Waste
  - Separate Waste Tank Will Have to Be Pumped Separately



Additional On-Site Wastewater System Protection

- Flow Equalization Tanks Prevents Overloading of Treatment During Peak Hours
  - Parks Experience High Flow During Morning, Evening



Additional On-Site Wastewater System Protection

- Bathhouses and Clubhouses Dilute HSE by Introducing More Water
  - Water from Laundry Machines, Showers, and Bathrooms That Will Decrease Concentration of Wastewater



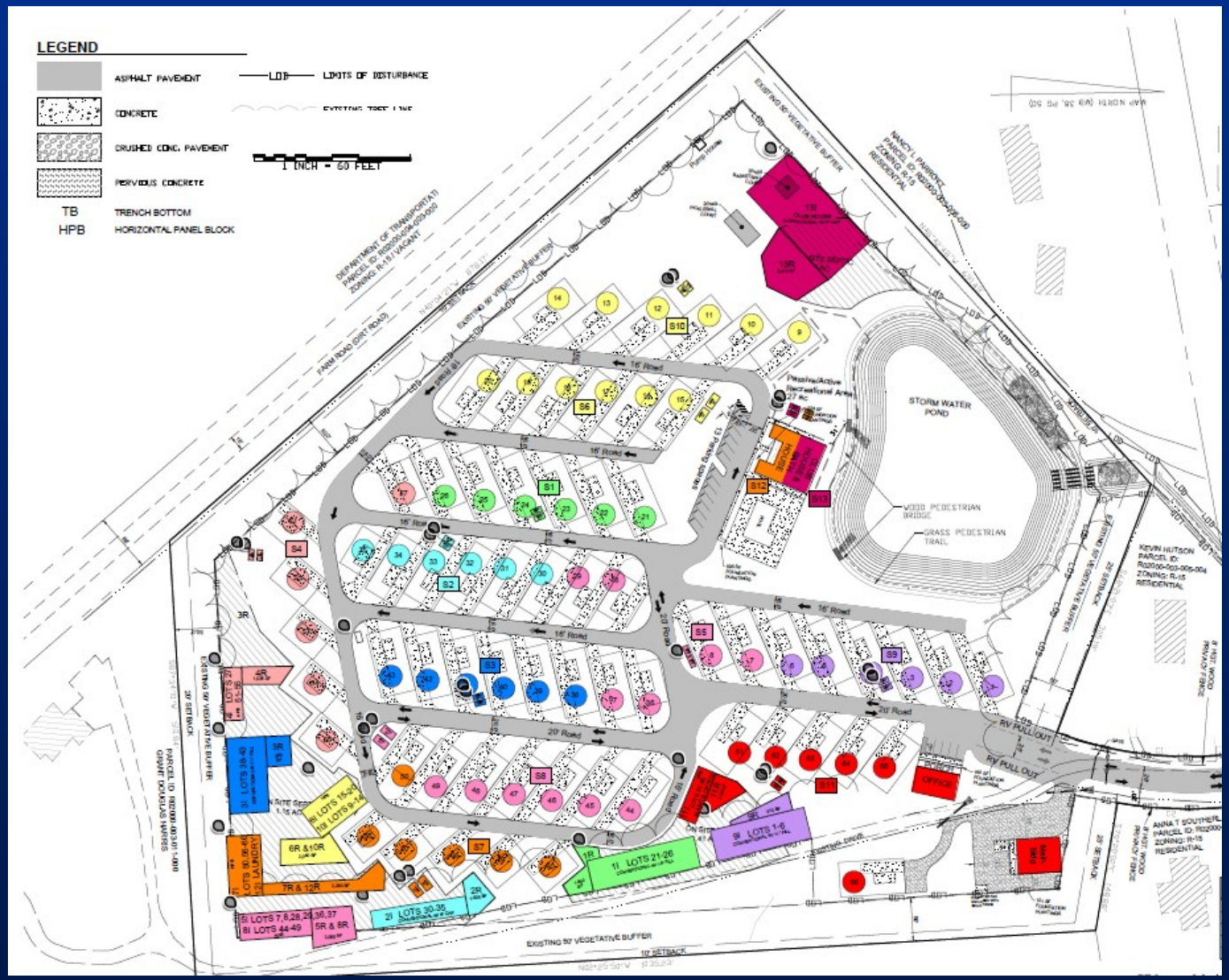
Concerns with Existing Parks

- What is there; Lack of information/records.
- Infiltration/ Inflow and Exfiltration: Open connections, leaky collection system, leak tanks, etc.
- Failing drainfield.
- Failing tanks.
- No repair field.
- Under designed.

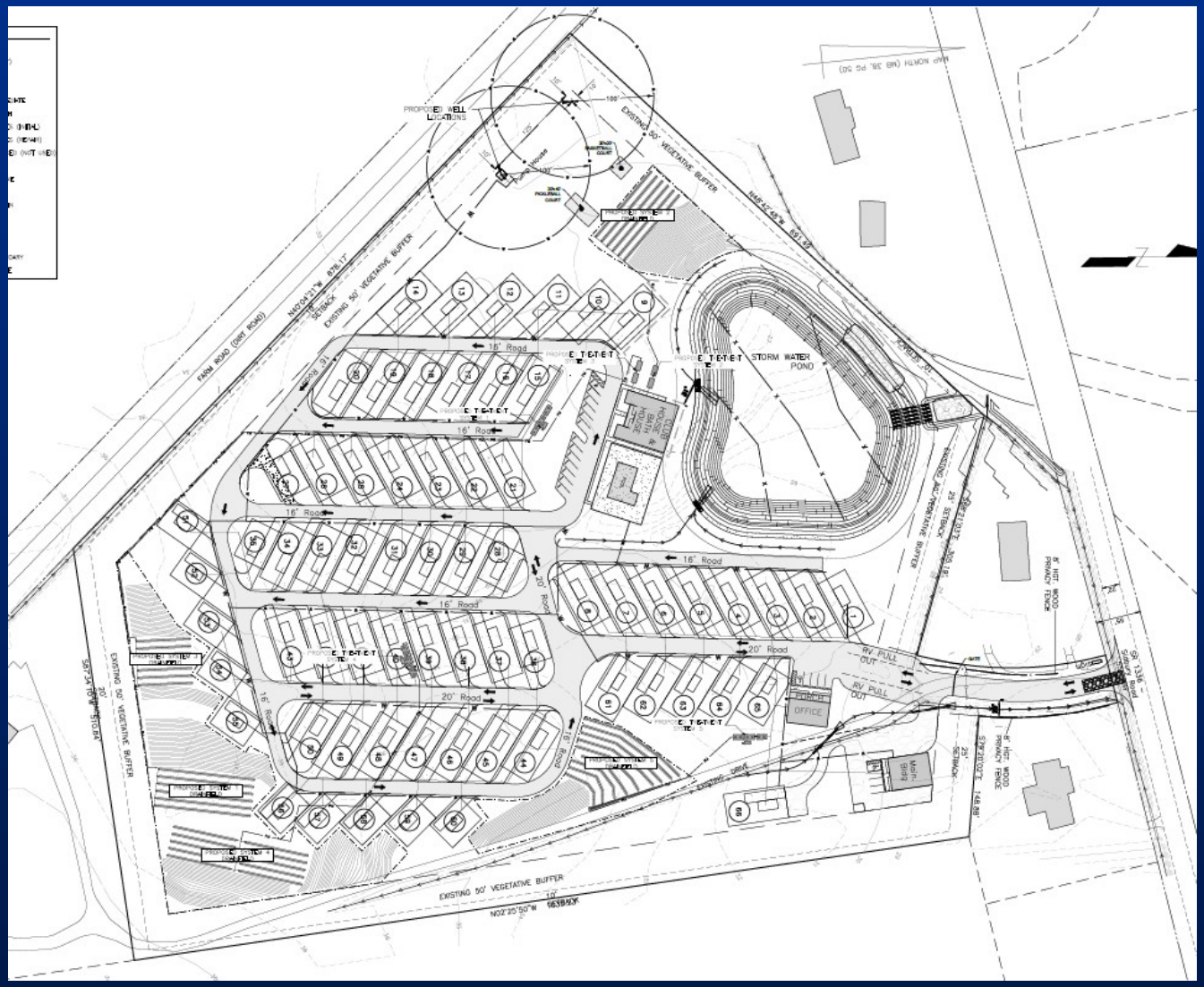
Steps in Planning a New RV Park "PPPPPPP"

- Get "Preliminary Soils Report" of property (defines capacity of site).
- Delineate wetlands, existing wells, features, etc.
- Get preliminary well site approval and drill well.
- Layout concept plan with respect to soils, wells, buffers, setbacks, zoning, etc.
- Financial Analysis.
- Do design and permitting.
- Construction.

1,500 GPD Park



Advanced Pretreatment Park



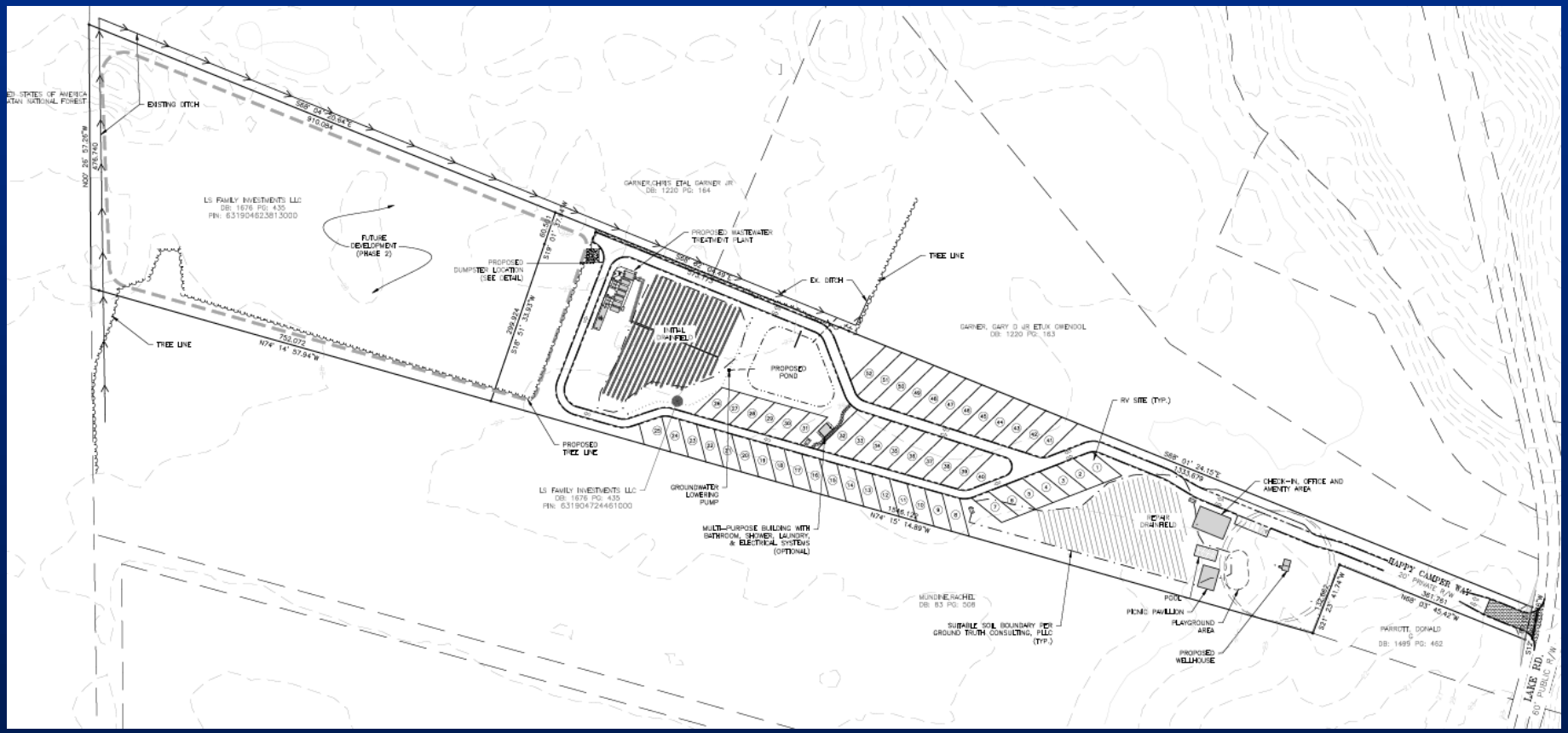
Collection Systems

- Conventional Gravity: 6-Inch Diameter with Cleanouts
- STEG: Septic Tank with Gravity
- STEP: Septic Tank Effluent Pump
  - Individual Sites
  - Multiple Sites

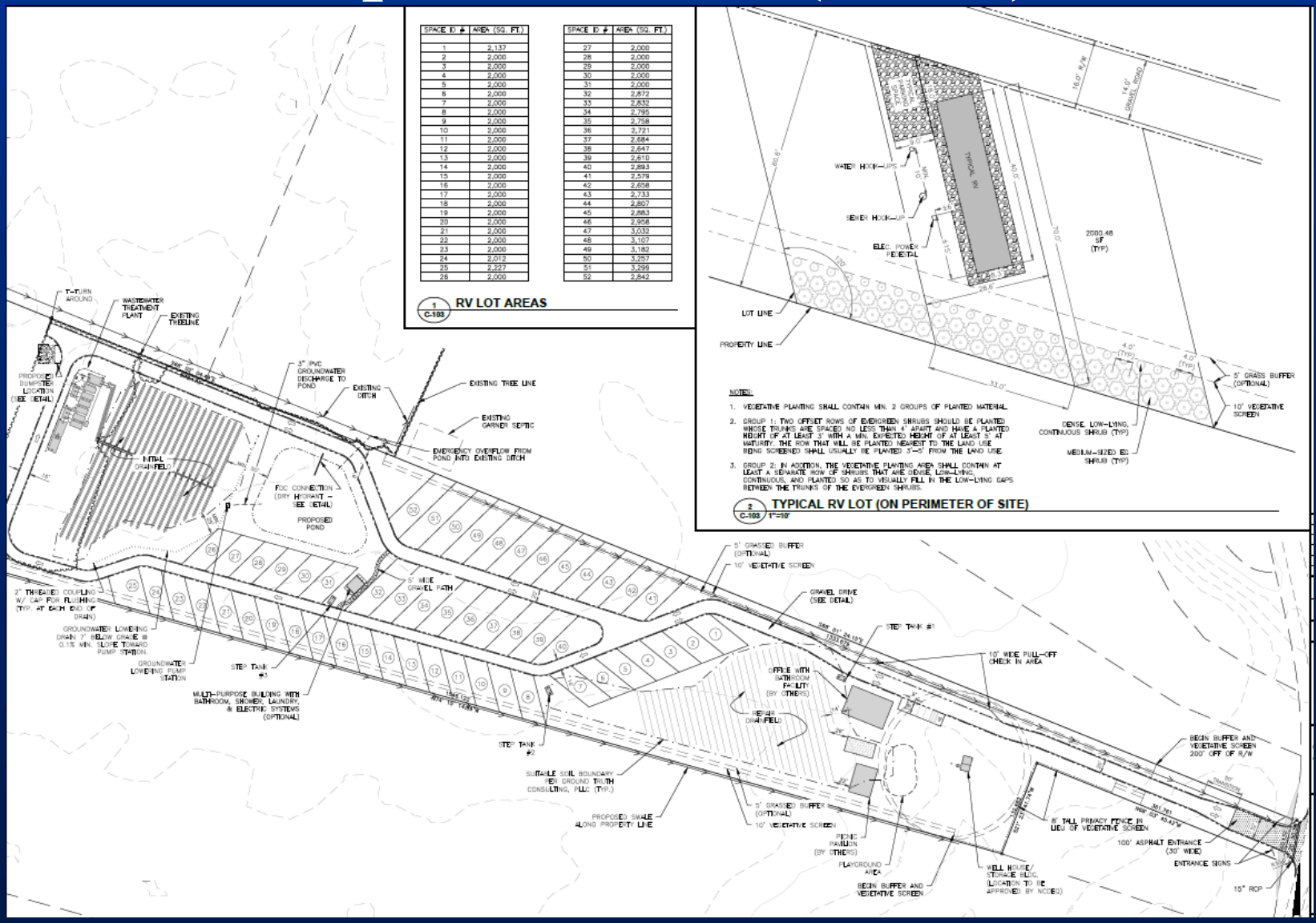
Small Park in North Carolina

- First Time Park Owner/Developer
- Phased Construction – Designed Initially
- STEP System with Recirculating Media Pre-Treatment
- Obtained Entitlements and Permits Up Front and Certify in Phases.

STEP Tank Park



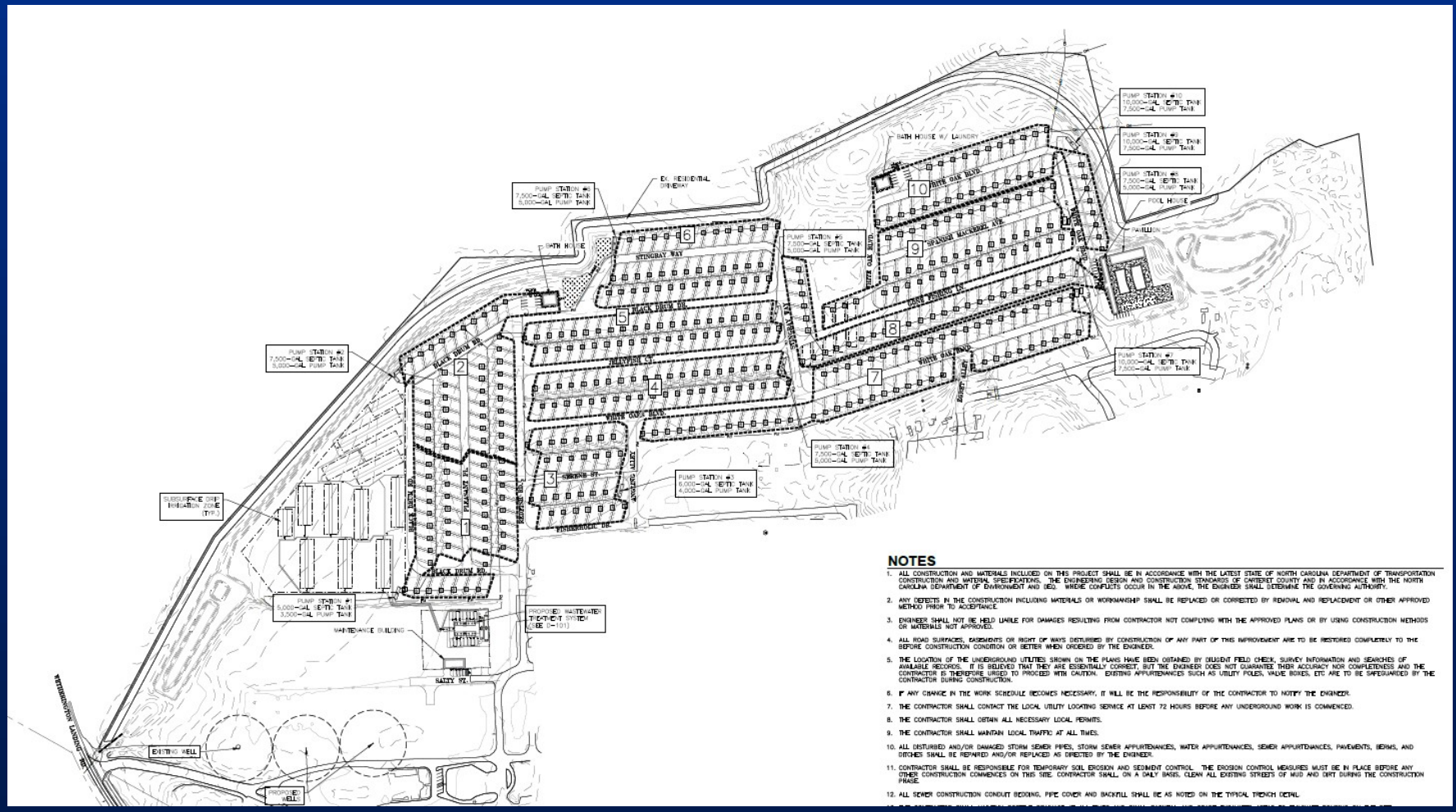
Step Tank Park (Cont.)



Large Park in North Carolina

- Expansion of Existing Park
- 400 Sites
- On-Site System
- Phased Construction – Designed Initially
- STEP System with Recirculating Media Pre-Treatment
- Obtained Entitlements and Permits Up Front and Certify in Phases.

Large Park (400 Lots)

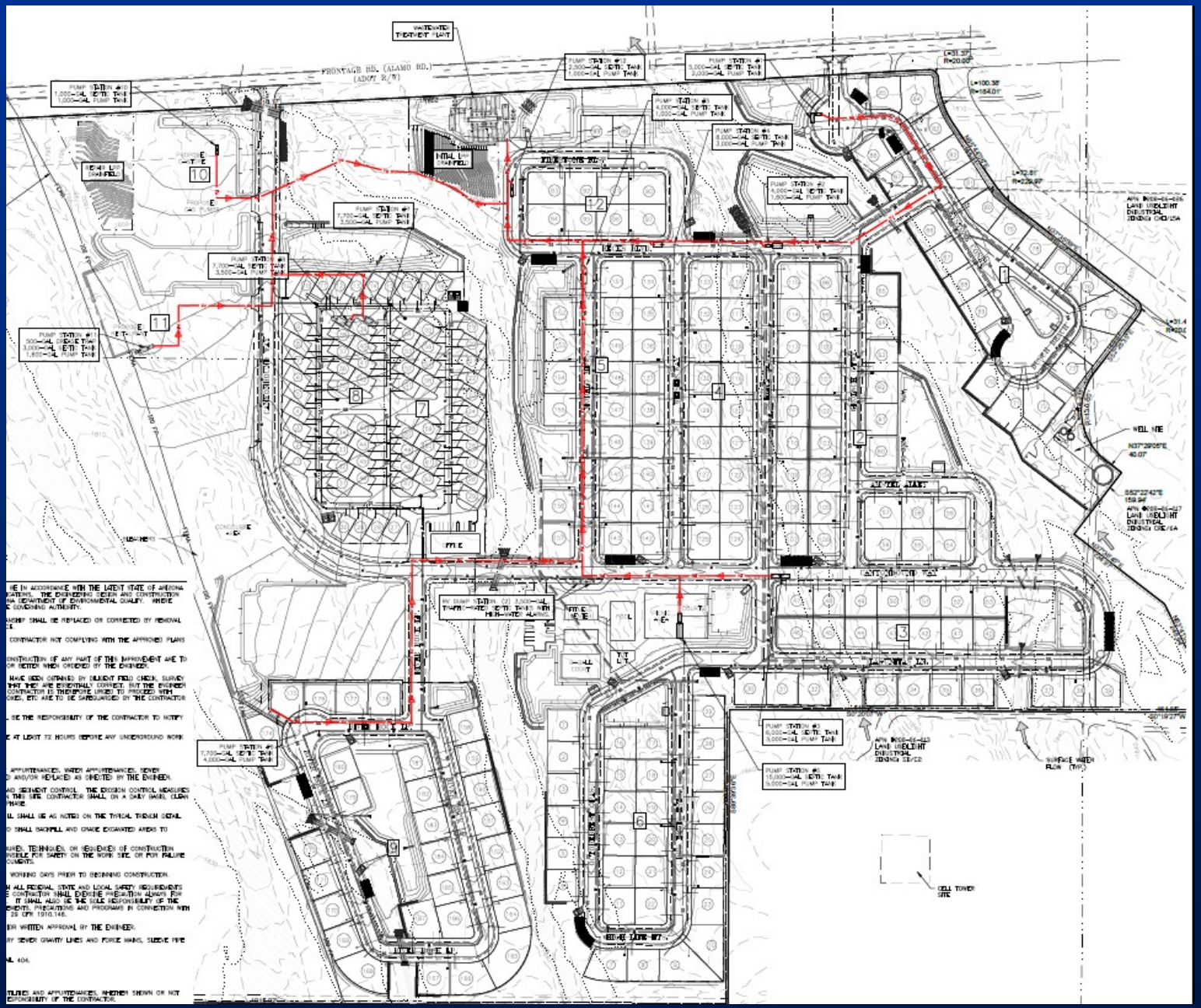


NOTES

1. ALL CONSTRUCTION AND MATERIALS INCLUDED ON THIS PROJECT SHALL BE IN ACCORDANCE WITH THE LATEST STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION CONSTRUCTION AND MATERIAL SPECIFICATIONS, THE ENGINEERING DESIGN AND CONSTRUCTION STANDARDS OF CARTERET COUNTY AND IN ACCORDANCE WITH THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND DEQ. WHERE CONFLICTS OCCUR IN THE ABOVE, THE ENGINEER SHALL DETERMINE THE GOVERNING AUTHORITY.
2. ANY DEFECTS IN THE CONSTRUCTION INCLUDING MATERIALS OR WORKMANSHIP SHALL BE REPLACED OR CORRECTED BY REMOVAL AND REPLACEMENT OR OTHER APPROVED METHOD PRIOR TO ACCEPTANCE.
3. ENGINEER SHALL NOT BE HELD LIABLE FOR DAMAGES RESULTING FROM CONTRACTOR NOT COMPLYING WITH THE APPROVED PLANS OR BY USING CONSTRUCTION METHODS OR MATERIALS NOT APPROVED.
4. ALL ROAD SURFACES, EASEMENTS OR RIGHT OF WAYS DISTURBED BY CONSTRUCTION OF ANY PART OF THIS IMPROVEMENT ARE TO BE RESTORED COMPLETELY TO THE BEFORE CONSTRUCTION CONDITION OR BETTER WHEN ORDERED BY THE ENGINEER.
5. THE LOCATION OF THE UNDERGROUND UTILITIES SHOWN ON THE PLANS HAVE BEEN OBTAINED BY DILIGENT FIELD CHECK, SURVEY INFORMATION AND SEARCHES OF AVAILABLE RECORDS. IT IS BELIEVED THAT THEY ARE ESSENTIALLY CORRECT, BUT THE ENGINEER DOES NOT GUARANTEE THEIR ACCURACY NOR COMPLETENESS AND THE CONTRACTOR IS THEREFORE URGED TO PROCEED WITH CAUTION. EXISTING APPURTENANCES SUCH AS UTILITY POLES, VALVE BOXES, ETC ARE TO BE SAFEGUARDED BY THE CONTRACTOR DURING CONSTRUCTION.
6. IF ANY CHANGE IN THE WORK SCHEDULE BECOMES NECESSARY, IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY THE ENGINEER.
7. THE CONTRACTOR SHALL CONTACT THE LOCAL UTILITY LOCATING SERVICE AT LEAST 72 HOURS BEFORE ANY UNDERGROUND WORK IS COMMENCED.
8. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY LOCAL PERMITS.
9. THE CONTRACTOR SHALL MAINTAIN LOCAL TRAFFIC AT ALL TIMES.
10. ALL DISTURBED AND/OR DAMAGED STORM SEWER PIPES, STORM SEWER APPURTENANCES, WATER APPURTENANCES, SEWER APPURTENANCES, PAVEMENTS, BERMS, AND DITCHES SHALL BE REPAIRED AND/OR REPLACED AS DIRECTED BY THE ENGINEER.
11. CONTRACTOR SHALL BE RESPONSIBLE FOR TEMPORARY SOIL EROSION AND SEDIMENT CONTROL. THE EROSION CONTROL MEASURES MUST BE IN PLACE BEFORE ANY OTHER CONSTRUCTION COMMENCES ON THIS SITE. CONTRACTOR SHALL, ON A DAILY BASIS, CLEAN ALL EXISTING STREETS OF MUD AND DIRT DURING THE CONSTRUCTION PHASE.
12. ALL SEWER CONSTRUCTION CONDUIT BEDDING, PIPE COVER AND BACKFILL SHALL BE AS NOTED ON THE TYPICAL TRENCH DETAIL.

New Park in Azizona

- Mixed Use Destination RV Park
- Custom Storage with RVs, and Overnight Hook-Ups
- Moto Cross Track
- Near Lake Havasu
- Trails for Motorcycles and 4-Wheelers
- Restaurant
- STEP System with Recirculating Media Pre-Treatment
- Obtained Entitlements and Permits Up Front and Certify in Phases.


WASTEWATER TREATMENT PLANT
FRONTAGE RD. (ALAMO RD.)
(ADOT R/W)
PUMP STATION #1
1,000-GAL SEPTIC TANK
1,000-GAL PUMP TANK
PUMP STATION #2
2,500-GAL SEPTIC TANK
1,000-GAL PUMP TANK
PUMP STATION #3
5,000-GAL SEPTIC TANK
2,000-GAL PUMP TANK
PUMP STATION #4
4,000-GAL SEPTIC TANK
1,000-GAL PUMP TANK
PUMP STATION #5
8,000-GAL SEPTIC TANK
3,000-GAL PUMP TANK
PUMP STATION #6
6,000-GAL SEPTIC TANK
1,500-GAL PUMP TANK
PUMP STATION #7
7,000-GAL SEPTIC TANK
3,500-GAL PUMP TANK
PUMP STATION #8
7,000-GAL SEPTIC TANK
3,500-GAL PUMP TANK
PUMP STATION #9
500-GAL GREASE TANK
3,000-GAL SEPTIC TANK
1,800-GAL PUMP TANK
PUMP STATION #10
7,000-GAL SEPTIC TANK
4,000-GAL PUMP TANK
PUMP STATION #11
6,000-GAL SEPTIC TANK
4,000-GAL PUMP TANK
PUMP STATION #12
15,000-GAL SEPTIC TANK
5,000-GAL PUMP TANK
WELL SITE
CELL TOWER SITE
SURFACE WATER FLOW (TYP.)
LAND USE:LIGHT INDUSTRIAL
ZONING:CI/C2/SA

Questions?

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& Associates, P. C.