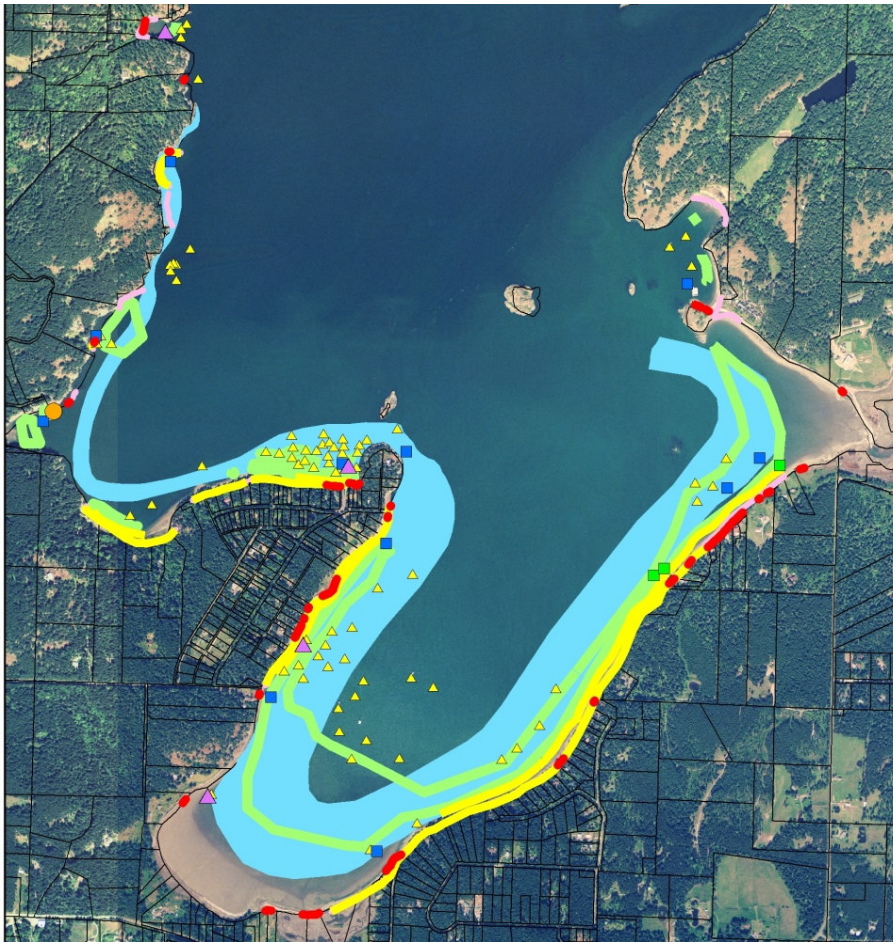
Shoreline Modification Inventory

for San Juan County, Washington



Mud/Hunter Bay Region, Lopez

July 2010

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Shoreline Modification Inventory for San Juan County, Washington

Acknowledgements

Friends of the San Juans' *2009 Shoreline Modification Inventory* would not have possible without the assistance of many individuals and organizations. Field survey efforts and GIS database development was led by James Slocomb. Undergraduate interns Tiffany Stephens and Samantha Palace and community volunteers Rick Exstrom, Craig Green, John Ashoff, Mary Masters and Chuck Rust collectively provided over 400 hundred hours of field assistance. Primary funding was provided by The Washington State Salmon Recovery Funding Board with matching support from ESRI, Robert Trimble and Jensen's Shipyard.

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Background

With over 400 miles of shoreline located at the confluence of Puget Sound, Georgia Strait and the Strait of Juan de Fuca, the nearshore marine habitats of San Juan County (SJC) play a critical role in the regional ecosystem. Protection of nearshore habitat has been identified at the local and regional levels as the most important salmon recovery strategy for the San Juan Archipelago (Shared Strategy 2005). The same forage fish species and nearshore habitats of interest in salmon recovery are also vital to the protection and restoration of additional key marine species including six stocks of Puget Sound rockfish; multiple species of seabirds, including the federally threatened Marbled murrelet; and the federally threatened Southern Resident Killer Whale.

Shore modifications, almost without exception, impact the ecological functioning of nearshore coastal systems and the proliferation of these structures has been viewed as one of the greatest threats (Thom et al. 1994). Modifications often result in the loss of the very feature that attracted coastal property owners in the first place, the beach (Fletcher et al. 1997). Bulkheads and other shore modifications that bury habitat, and limit bluff erosion and littoral sediment transport have led to major changes in sediment supply and associated changes in beach and habitat stability. The cumulative impact of human modifications to the shoreline may be far-reaching in terms of both habitat and existing human activities, particularly in the face of anticipated increases in the rate of sea level rise and storm induced erosion.

Coastal geomorphic processes create and maintain the nearshore habitats upon which many Puget Sound species of concern rely, including forage fish spawning areas, and juvenile salmonid rearing and migratory habitats, among others (Fresh 2006, Penttila 2007, Johannessen and MacLennan 2007). A recent study by C. Rice (2006) documented the effects of shoreline modifications on Puget Sound beaches on surf smelt mortality. Results showed that anthropogenic alteration of the shoreline typically makes beaches less suitable for surf smelt embryo survival when compared with unmodified shores (Rice 2006). Loss of marine riparian areas is commonly associated with shoreline development and anthropogenically modified shores.

Shoreline modification is identified as a top threat to the SJC marine ecosystem (SJC Marine Stewardship Area Plan 2007) and protection of unmodified habitat was a primary focus for the San Juan Initiative's ecosystem research. The San Juan Initiative's Case Study of 40 miles of marine shoreline within San Juan County documented a predominance of shore modifications along feeder bluffs, transport zones, accretion shoreforms and pocket beaches, which all provide habitat for important marine species including forage fish and eelgrass (Johannessen and MacLennan 2008). The location of most modifications along non rocky shorelines means that impacts are concentrated in areas important to forage fish spawning habitat and habitat forming processes. With just twelve miles of documented forage fish spawning habitat in SJC, improved protections are needed to ensure maintenance of these habitats over the long term.

In 2007, Friends of the San Juans (FSJ) completed an *Analysis of Shoreline Permit Activity in San Juan County (1972-2005)* and found that over 300 permits are granted each year by the County for shoreline structures, excluding houses (Whitman 2007). The analysis also found that no-net-loss and sensitive areas regulations adopted in the 1990's have not reduced the number or rate of shoreline permits granted that impact priority nearshore habitats including eelgrass and documented forage fish spawning habitats (Whitman 2007). Permits

for expansion of existing armoring and new armoring at known surf smelt and Pacific sand lance spawning habitats and docks over eelgrass continue to be granted in SJC by both county and state regulators.

The majority of shoreline development activity in San Juan County occurs through incremental single-family development and individual shoreline alterations. The magnitude of these impacts may only become evident cumulatively over time. To date, no attempt has been made to evaluate the cumulative impacts of incremental shoreline development. Without a complete inventory of San Juan County's existing shoreline modifications, it is not possible to understand the extent of the problem, identify priority restoration projects, and reduce future impacts.

In 2009, FSJ conducted a boat-based inventory and mapping project of shoreline modifications for all 400+ miles of marine shoreline within San Juan County. Results show that the current level of impact to shoreline habitats is much higher than previously believed and that the vast majority of impacts are associated with residential shoreline development.

Methods

A shallow water field assessment of all marine shorelines was completed aboard a small boat. Field surveys were primarily conducted at mid to high tidal elevations, to support traveling in close proximity to the shorelines. Surveys were carried out from April to July of 2009. At each point where a shoreline modification was encountered, two data records (electronic and hard copy) were collected for each structure. Data collected included: GPS point; recorder name and region; date and waypoint; two georeferenced digital photos; and information on modification type, material, size, condition, design and tidal elevation. All survey records were collected from boat except for the following three extremely shallow locations: Buck Bay, Orcas Island, inner Fisherman's Bay, Lopez Island and False Bay, San Juan Island where data was collected from a combination of land reconnaissance and aerial photo interpretation.

The basic data categories included: Armoring; Docks; Marinas/Jetties/Breakwaters; Improved Boat Ramps; Marine Railways; Groins; Moorings and Floats; Pilings and Other. Because of the high number of structures and the challenges with accurately locating and documenting pipes using the boat based field survey methodology, stormwater outflow pipes and stairs were not included in this inventory. However, armoring greater than 5 feet in lenth associated with outflows and stairs was recorded. At the end of each field day the memory cards were extracted from the camera and data collector and all data was transferred to the master map using the standard ESRI procedure for checking field data into the ArcGIS project. This allowed visual verification that the day's data was successfully integrated into the map. All data were then immediately backed up and paper copies of records stored chronologically. Because survey methodology records the location of all the observed objects just offshore of their true location, a combination of field records and aerial photo review were utilized to join each structure to the correct location and shoreline tax parcel. More detailed field to ArcGIS database methodology is provided in the associated database distribution DVD Readme.doc.

Results

Just under 3,500 modifications were mapped, photographed and described and included: 710 armored beaches, 472 docks, 32 groins, 55 marine railways, 70 improved boat ramps, 50 marina/jetty/breakwater, 116 piling groupings and 191 "other" on-beach structures. Information on structure size, material, tidal elevation and collection were recorded where relevant to inform understanding of potential habitat impacts and support the identification and prioritization of restoration opportunities.

Armoring

A total of 710 individual records were recorded for shoreline armoring, covering over 18 linear miles of SJC's total marine shorelines. The minimum armor length recorded was 6.5 feet. Maximum armor length recorded in the 2009 inventory was 3,513 feet and the mean length of armoring was 137 feet. The majority of armoring (674 or 95%) was associated with residential bulkheads. Armoring was also associated with beach access (155), roads (51), boat ramps (20), stormwater outfalls (14), road ends (8), breakwaters (3), groins (3) and jettys (2).

1,096 shoreline tax parcels (24%) had armoring present in the 2009 surveys. As documented by the San Juan Initiative's Case Study (MacLennan and Johannessen 2008), armoring was concentrated on sand/gravel or "soft", non-rock shorelines. When analyzed with tax parcels on the approximately 320 miles of rocky shorelines removed, the proportion of armored soft shore shoreline tax parcels increases to nearly half of shoreline parcels (49%). While just 4% of the total marine shorelines within San Juan County are armored, the percent armored jumps to 22.5% for the 80 miles of sand/gravel shorelines.

The majority of shoreline armoring consists of large rock (505), followed by small rock (364), wood (182), creosote wood (56), concrete (140) and gabion basket (9) construction. While the majority of armoring was in good condition (483), a significant proportion (200) were in degraded or poor condition. The waterward toe of bulkhead elevations ranged from a minimum of -2 M.L.L.W. to a high of + 11 M.L.L.W., with a mean of +5.7 M.L.L.W. These results indicate that the majority of bulkheads are located where they are directly impacting intertidal habitats through burial. As one example of direct habitat impacts, forage fish spawning and incubation normally occurs on upper beach habitat within the +7 to +9 M.L.L.W tidal elevation zone (Moulton and Penttila 2001). In addition to direct burial impacts, lower elevation structures also typically have larger indirect effects such as increased erosion at the ends and toe of the structure, bulkhead associated vegetation removal and loss of fine sediments over time on the beach face.

Docks

A total of 472 docks (excluding marinas and large community docks) were documented along San Juan County's marine shorelines. Of these, 42 (8%) had grated floats and 17 (3%) had grated piers. 356 (77%) docks with creosote wood piles and/or decking were recorded. 39 (8%) docks were noted to be in poor condition.

Groins

Thirty two groins were documented along the marine shorelines of San Juan County. The lower elevation of all documented groins was below the water line at the time of the survey. Upper beach elevations of groin structures ranged from +2 M.L.L.W. to +9 M.L.L.W., with a mean of +3.8 M.L.L.W. Groin elevation can play an

important role in evaluating potential or likely impacts to habitat and habitat forming processes such as burial of forage fish spawning substrate and disruption of sediment transport.

Marine Railways

Fifty five marine railways were documented along the marine shorelines of San Juan County in the 2009 inventory.

Boat Ramps

Seventy improved boat ramps (includes permanent on beach structures such as concrete pads) were documented along the marine shorelines of San Juan County in the 2009 inventory.

Marinas/Jettys/Breakwaters

A total of fifty structures were classified as marinas/jetties/breakwaters, including a number of large community docks. Detailed information beyond the locational waypoint and digital photograph was not collected for this category of structure, a result of the cost/benefit ratio of survey effort required and low restoration potential.

Pilings

One hundred and sixteen groupings of pilings (not associated with another existing structure such as a dock or marina) were documented along San Juan County's marine shorelines, including 425 individual pilings. Piling material was overwhelmingly creosote (89%).

Mooring Buoys and Floats

A total of 1,914 mooring buoys and floats were recorded in the 2009 field inventory, including 1,835 buoys and 79 floats (not associated with a dock or marina), and average of 4.7 per linear marine shoreline mile. Data recorded for buoys was limited to GPS location. For floats, a GPS location and photo was collected.

Other

A total of 191 additional modifications were documented in the 2009 county-wide inventory of San Juan County's marine shorelines. Structures included on-beach items such as boathouses, hot tubs, patios, lime kilns etc. Following the field surveys, the "other" category was reviewed and reclassified into five categories including: *Other Structure: functioning* (65); *Other Structure: derelict* (51); *Ferry* (4); *Platform* (59) and *Aquaculture* (1).

Key Findings

1. ***Current shoreline impact level in San Juan County is greater than previously believed, and comparable with other rural Puget Sound Counties.***

When looked at with other areas with comparable shoreline inventory data sets, San Juan County's current level of shoreline development is similar to other rural areas around Puget Sound, including Hood Canal, east Jefferson County and Whatcom County (outside of Bellingham City limits). As an example, for all shoreline

structures except buoys (buoy data not included in Point No Point Treaty Council assessment), San Juan County has an average of 4 modifications per marine shoreline mile, while Hood Canal to East Juan de Fuca (Union River to Dungeness Spit, including City of Port Townsend), has an average of 3 modification per marine shoreline mile (Point No Point Treaty Council 2003). In another example, the percentage of armored sand/gravel shorelines, with rocky shores removed, is also comparable: 22.5% sand/gravel shorelines armored in San Juan County; 18% sand/gravel shorelines armored in Hood Canal to east Juan de Fuca (Point No Point Treaty Council 2003) and 18% sand/gravel shorelines armored in rural Whatcom County (excluding City of Bellingham) (Whatcom County 2006).

2. Impacts concentrated on non-rocky shorelines

As documented by the San Juan Initiative's Case Study investigation of 40 miles of marine shorelines within four regions of San Juan County (Johannessen and MacLennan 2008), FSJ's 2009 modification inventory found a predominance of shore modifications along not just feeder bluffs but also along transport zones, accretion shoreforms and pocket beaches, which all provide habitat for important marine species. The location of most modifications along non rocky shorelines means that impacts are concentrated in areas important to key species and processes such as forage fish spawning habitat and habitat forming processes. With the majority of impacts concentrated along just 20% of the total marine shoreline miles in San Juan County (remaining 80% is rocky shore), significantly improved protections will be needed to address cumulative impacts to these shore types.

3. Significant restoration opportunities exist

Process-based restoration has been recognized as the ideal means of restoring Puget Sound nearshore environments (Leschine and Petersen 2007, Johannessen and MacLennan 2007, Shared Strategy 2005). Process-based restoration attempts to restore and protect those self-sustaining processes that support the ongoing maintenance of habitats on a landscape scale. The connections between coastal processes and nearshore habitats is complex and occurs at multiple spatial and temporal scales, all of which require detailed information on the location and extent of habitats and human impacts as well as adequate policy language to effectively manage development and protect natural resources.

Many degraded, outdated or unnecessary shoreline structures were documented in the 2009 Shoreline Modification Inventory for San Juan County. Collection of detailed size, material and condition data will support future restoration prioritization and landowner outreach efforts by FSJ and others. For example, the high number of degraded bulkheads presents a significant opportunity to restore habitat through structure removal where feasible or enhance habitat by rebuilding structures (higher beach elevation, smaller beach footprint using modern design standards, replacement of hard armor structure with soft shore protection methods, etc.).

This fall, FSJ, with the involvement of an interdisciplinary technical team, will analyze shoreline modification inventory results with spatial species and habitat data to identify and prioritize shoreline restoration projects at the county scale. Project results will be used to inform San Juan County salmon recovery efforts. FSJ will also conduct significant landowner outreach efforts at potential restoration sites to identify interested landowners for voluntary restoration efforts.

4. Significant protection challenges ahead

Despite the fact that approximately half of the shoreline tax parcels within San Juan County have not yet been developed with a residence, 40% of shoreline parcels already have a shoreline modification. As demand for additional shoreline structures will come from already developed parcels as well as newly developed shoreline lots, rates of impact are likely to increase over time. In addition, recent analysis of County permit trends indicates that the rate of armoring permitted through the Shoreline Exemption process is rapidly increasing. This situation is expected to be further exacerbated by the combined variables of sea level rise and associated increases in storminess, demand by property owners to fortify existing structures and the ongoing permitting of residential structures within close proximity to marine shorelines.

While considered a rural county, shoreline tax parcel sizes within San Juan County are more closely associated with suburban levels of development. With shoreline natural areas and parks removed, the mean or average size of marine shoreline tax parcels within the county is 5.37 acres, the median or middle value is 1.32 acres, and the mode or most common value is 0.68 acres. With over 4,600 current marine shoreline tax parcels, the cumulative impacts of shoreline modifications are likely to be large, unless significant management improvements are made that change the current shoreline modification development patterns.

Conclusions

While each individual shoreline modification may not be negatively impacting habitat, and all are not avoidable, many are negatively impacting habitat, and many are avoidable. FSJ's Shoreline Modification Inventory results indicate that the cumulative impacts of current shoreline development to marine habitats and habitat forming processes are likely significant. In the face of declining marine species and habitats and increasing human populations and shoreline development pressures, coordinated and improved protection at the local, state and federal level will be required to meet the multiple objectives of no net loss of habitat function, endangered species recovery and property protection. Understanding of current on-the-ground conditions, and the likely cumulative impacts of the current level of shoreline modification, is needed to efficiently and effectively plan both restoration and protection programs.

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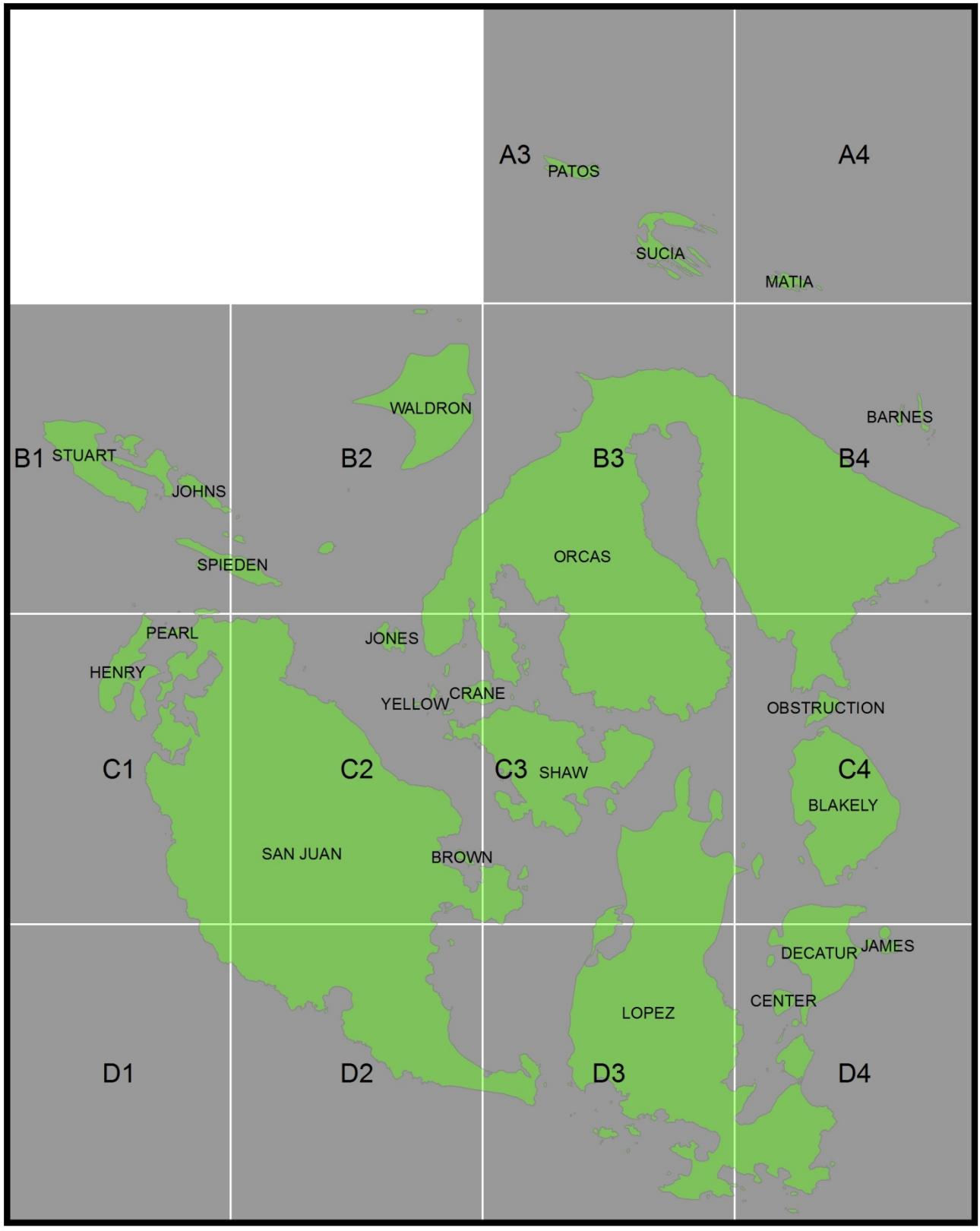
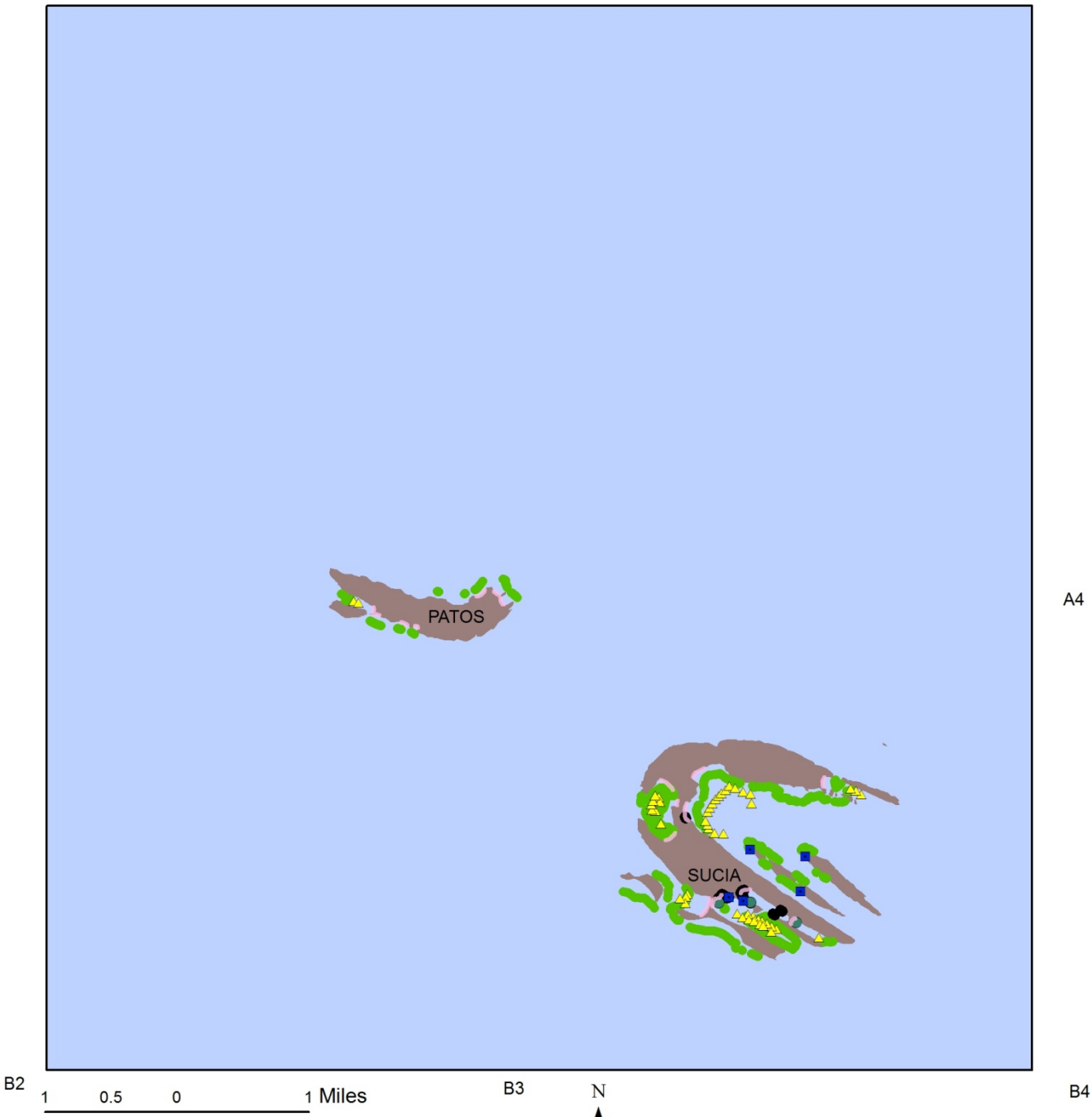


San Juan County
Shoreline Modification Inventory
MAPBOOK

FRIENDS OF THE SAN JUANS

San Juan County Shoreline
MODIFICATION INVENTORY



Legend

- Armoring
- Improved Boat Ramp
- Marine Railway
- Mooring Buoy
- Dock
- Groin
- Pilings
- Roads
- Known Forage Fish Spawn Habitat
- Potential Forage Fish Spawn Habitat
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A3

FRIENDS OF THE SAN JUANS

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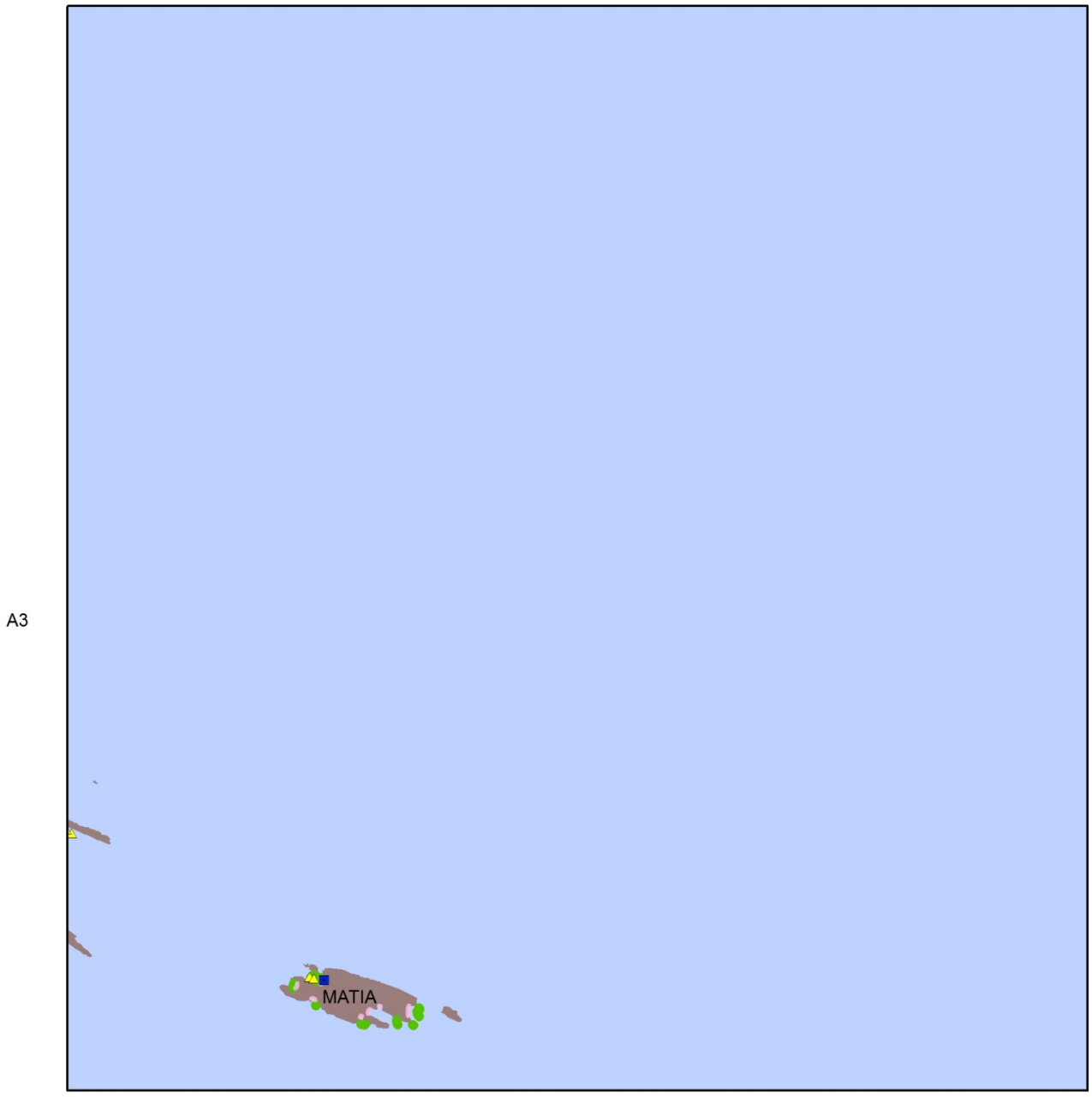

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B1

FRIENDS OF THE SAN JUANS

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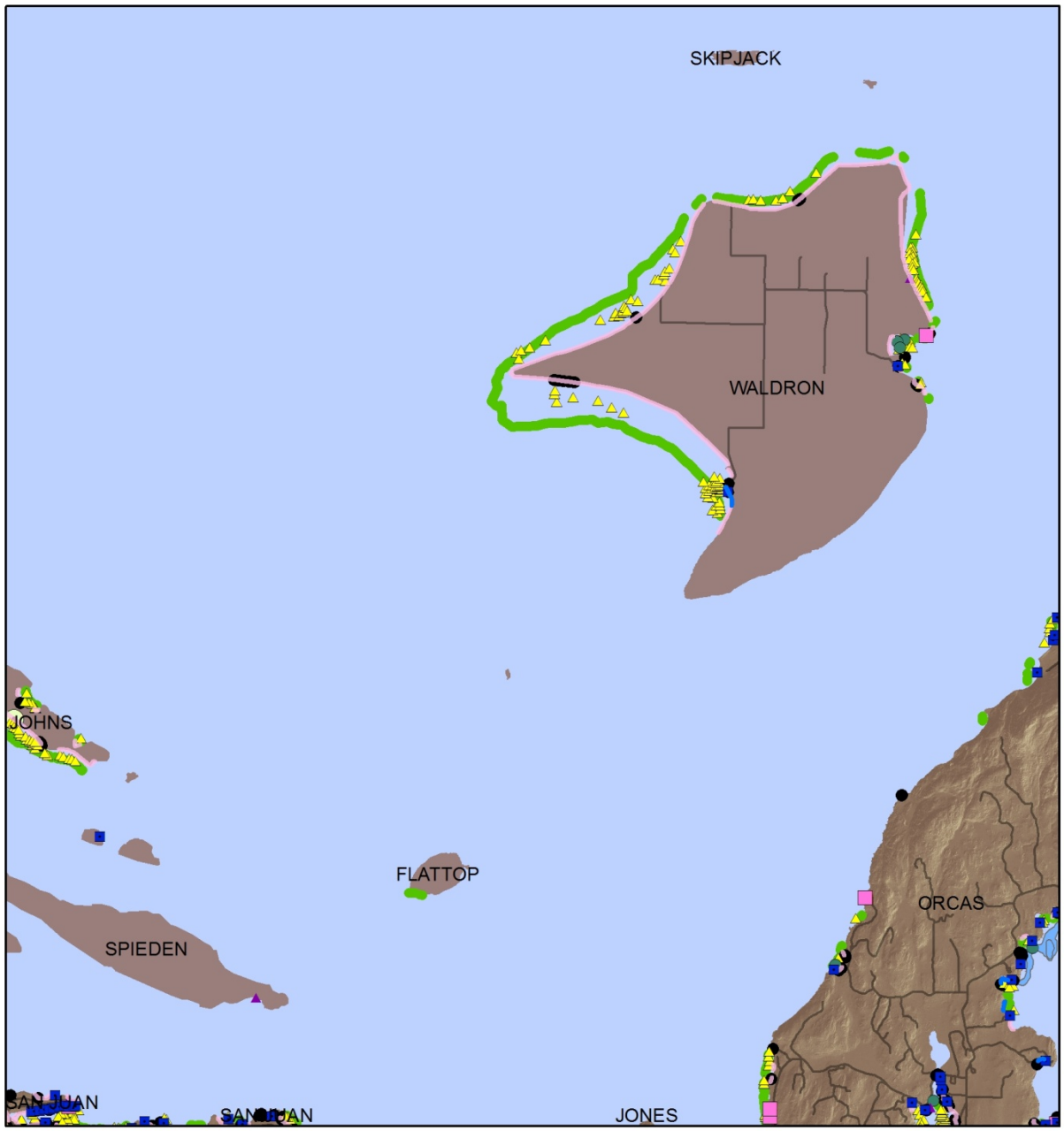

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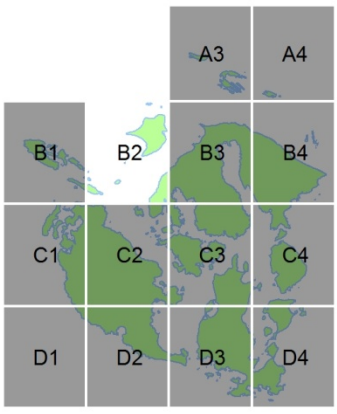

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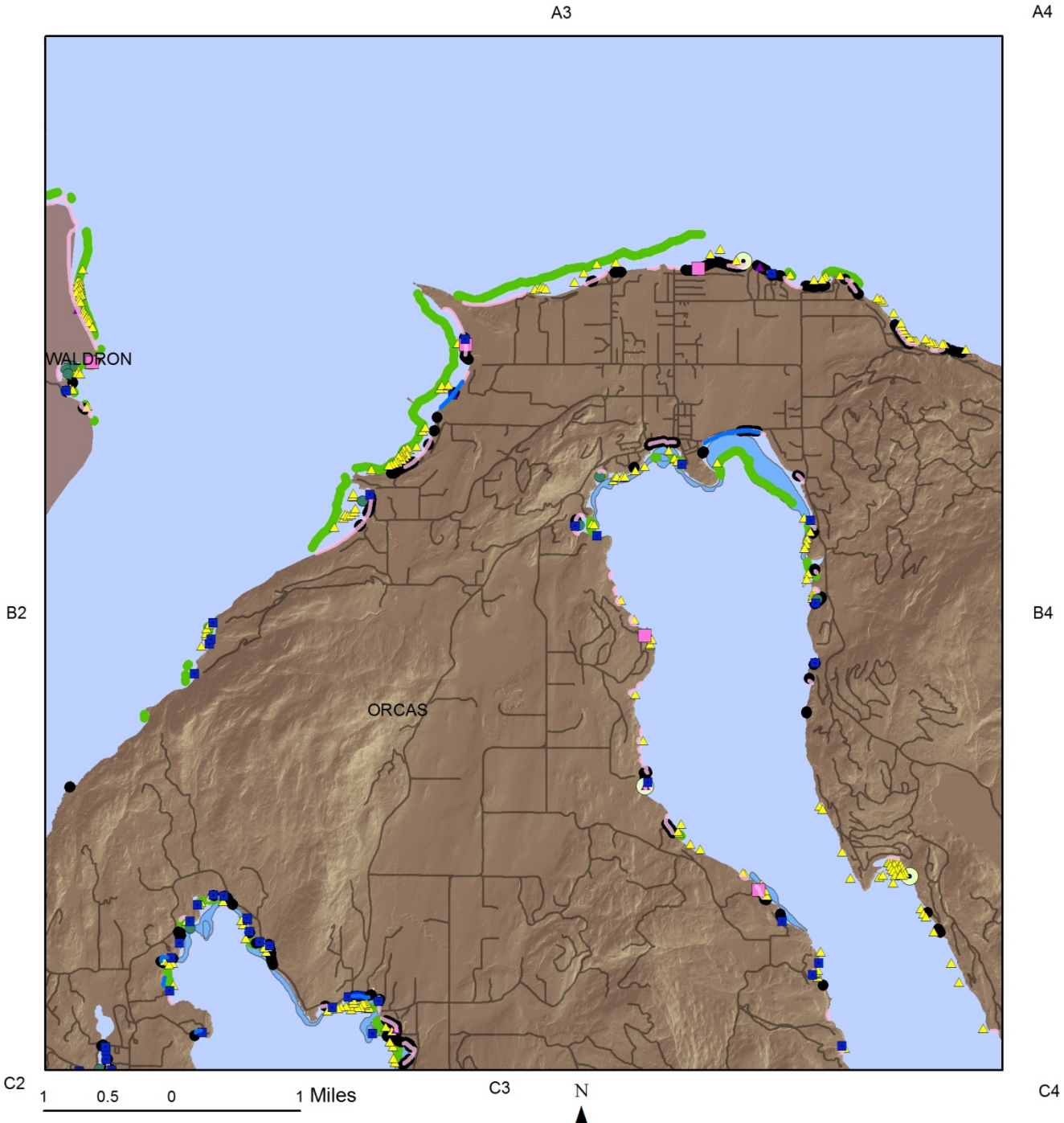

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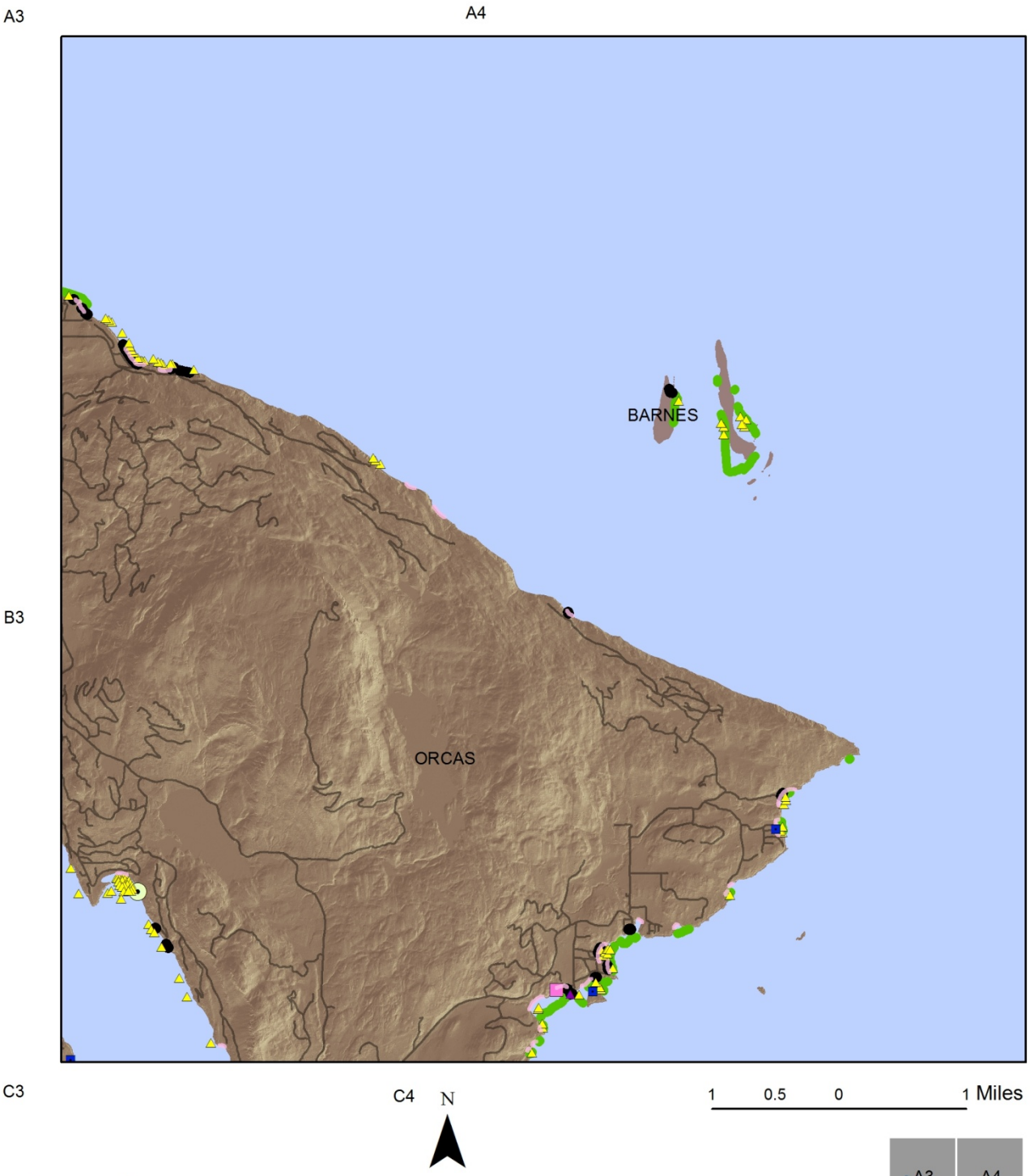

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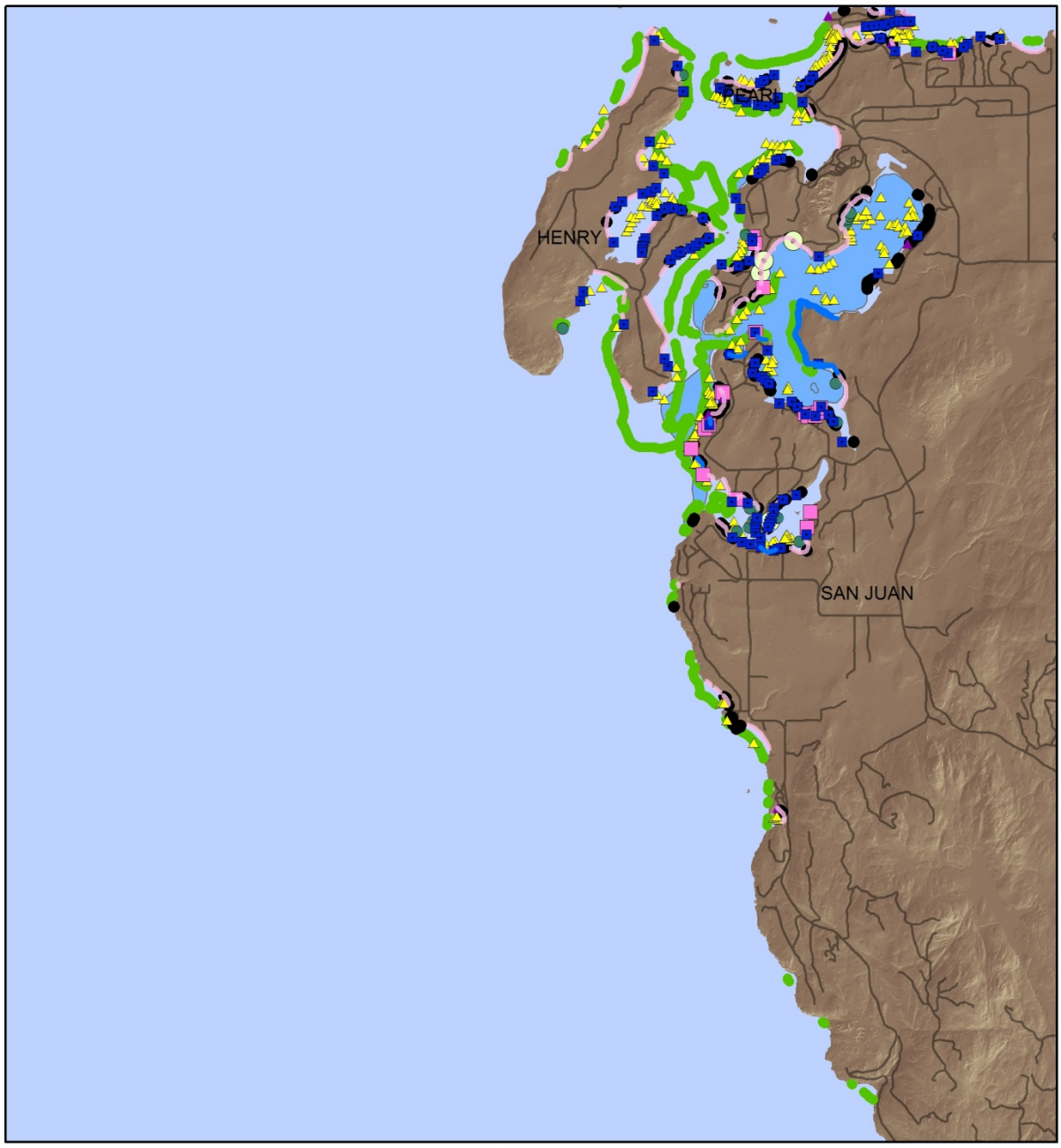

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C1

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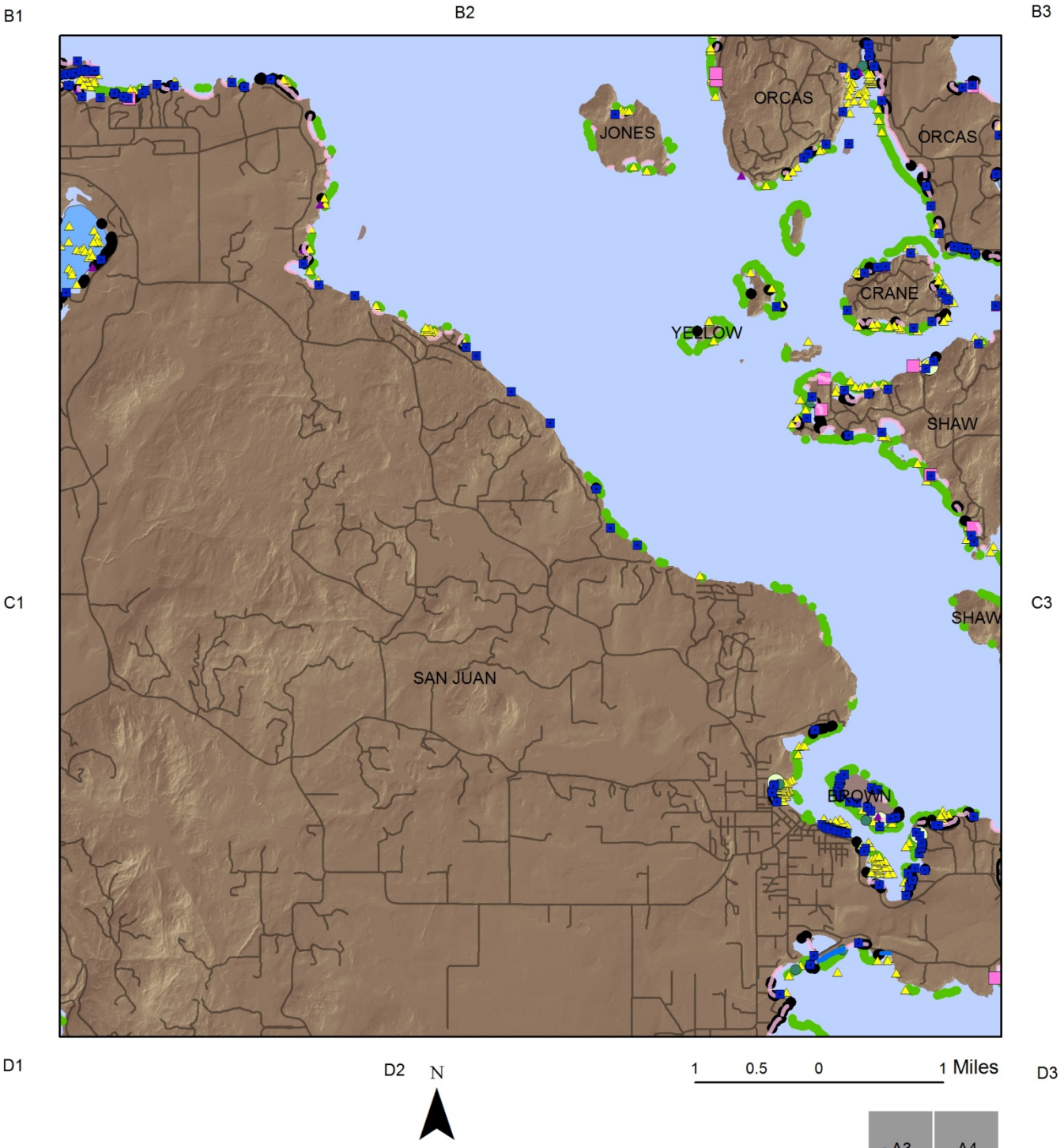

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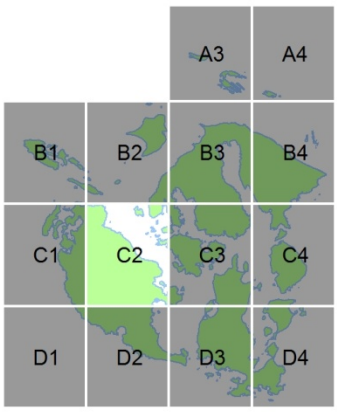

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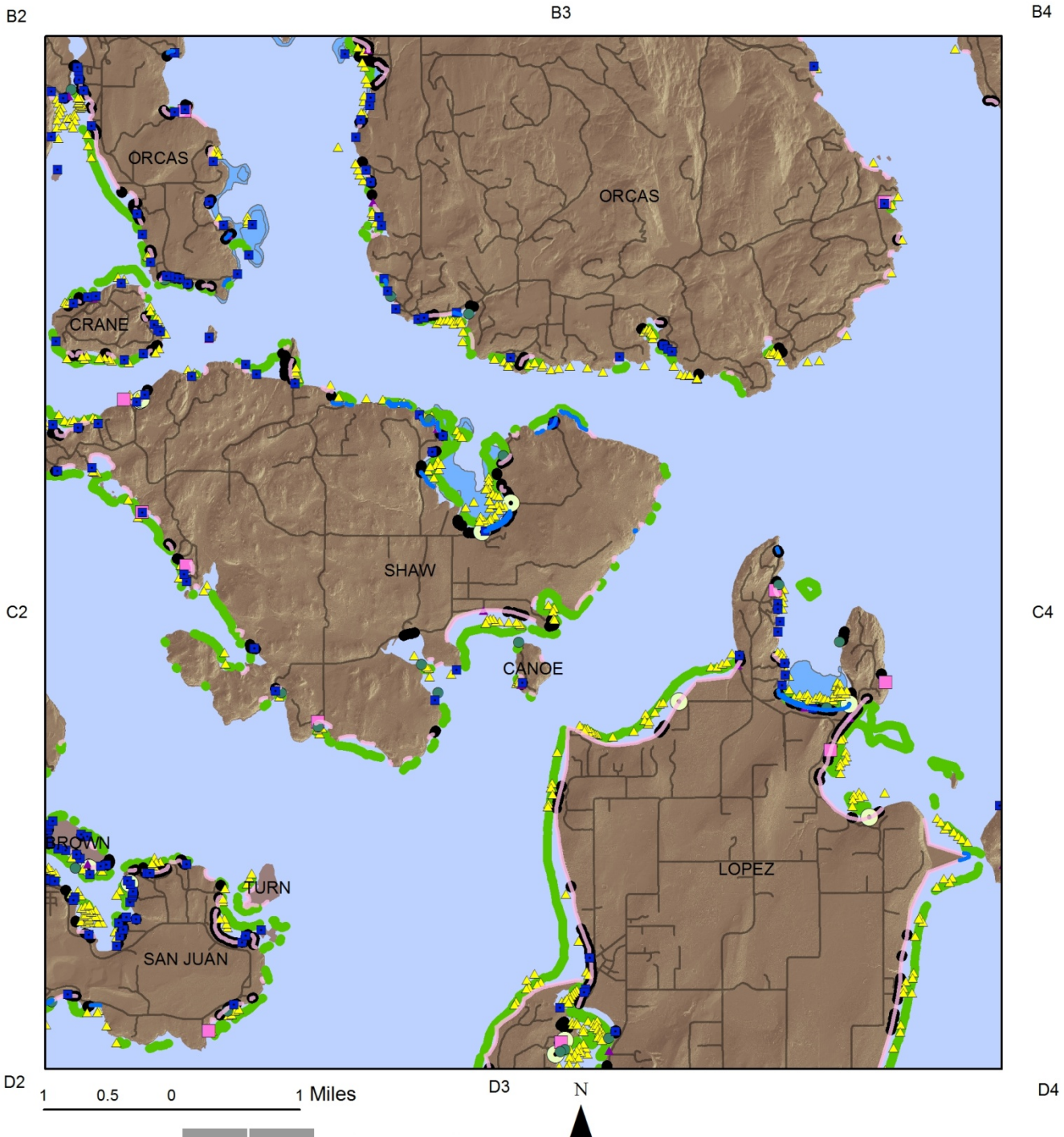

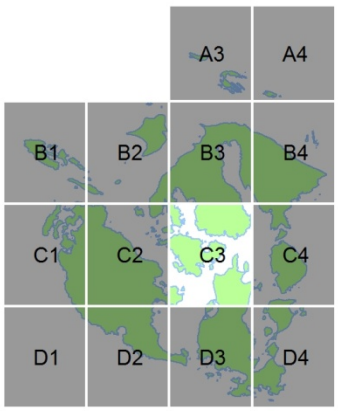

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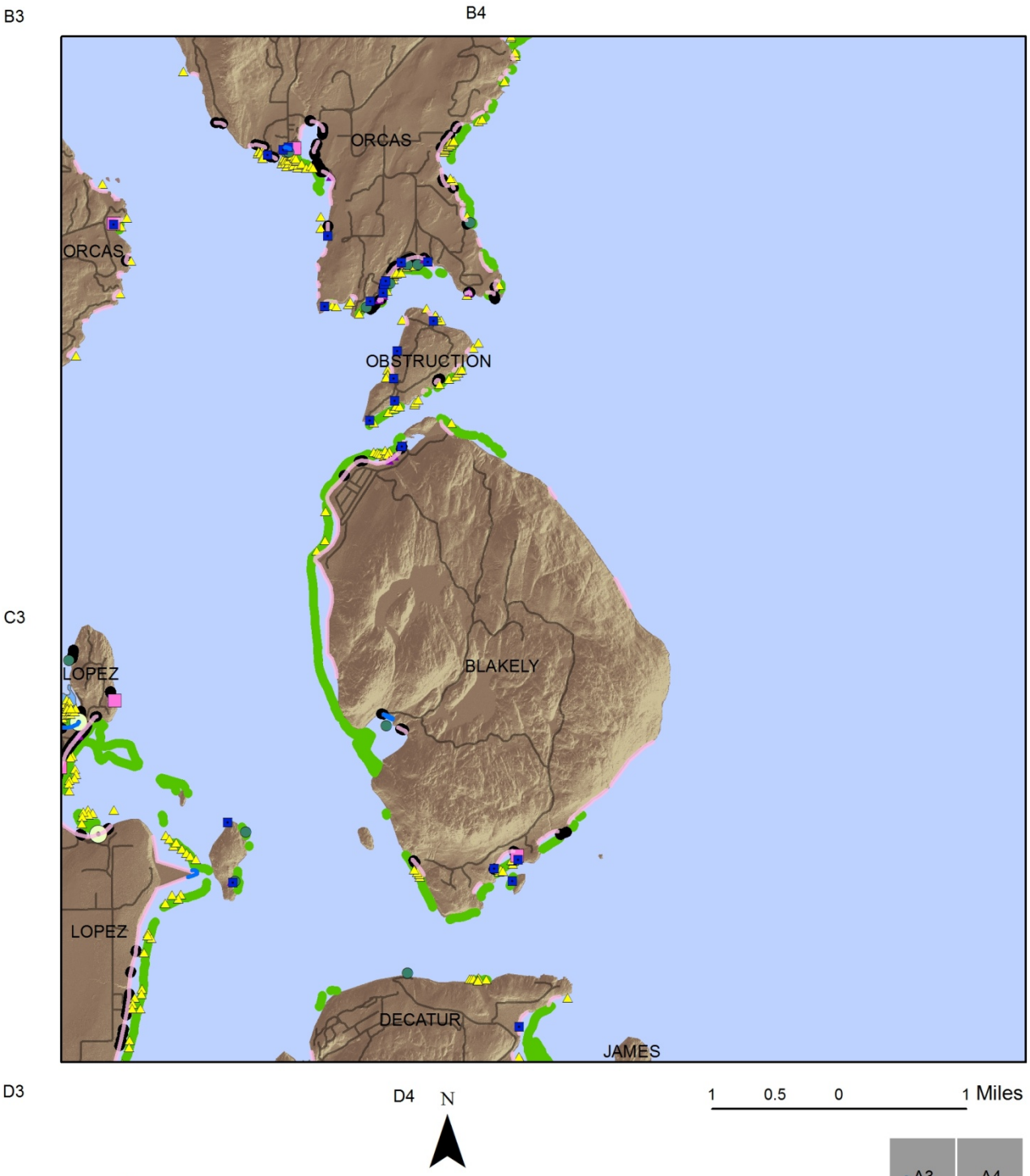

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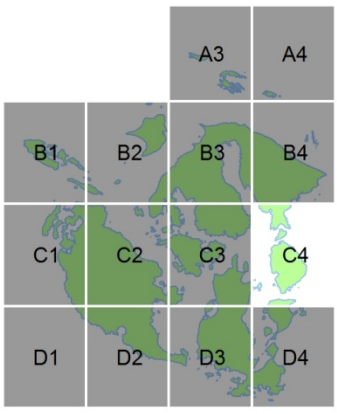

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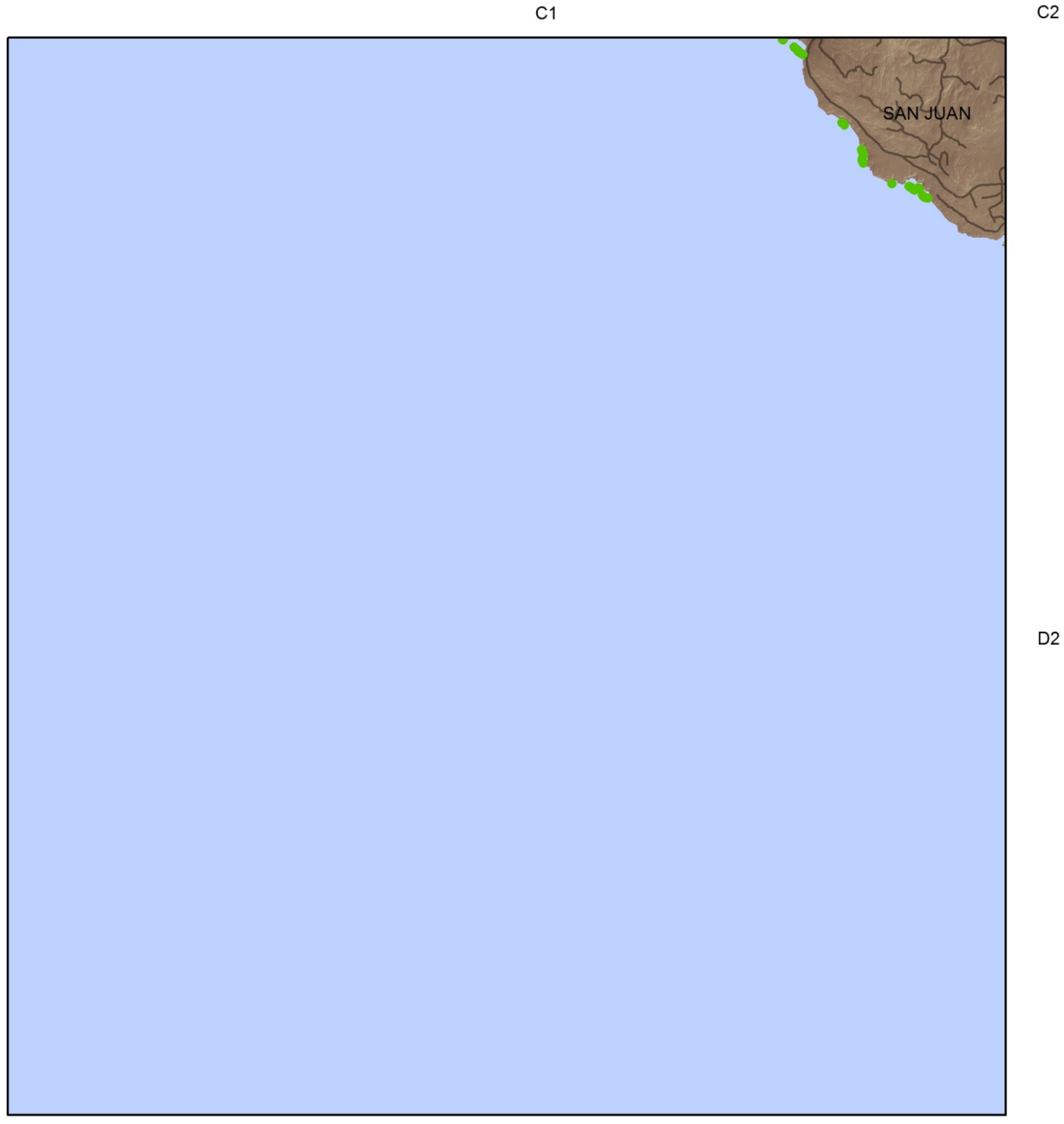

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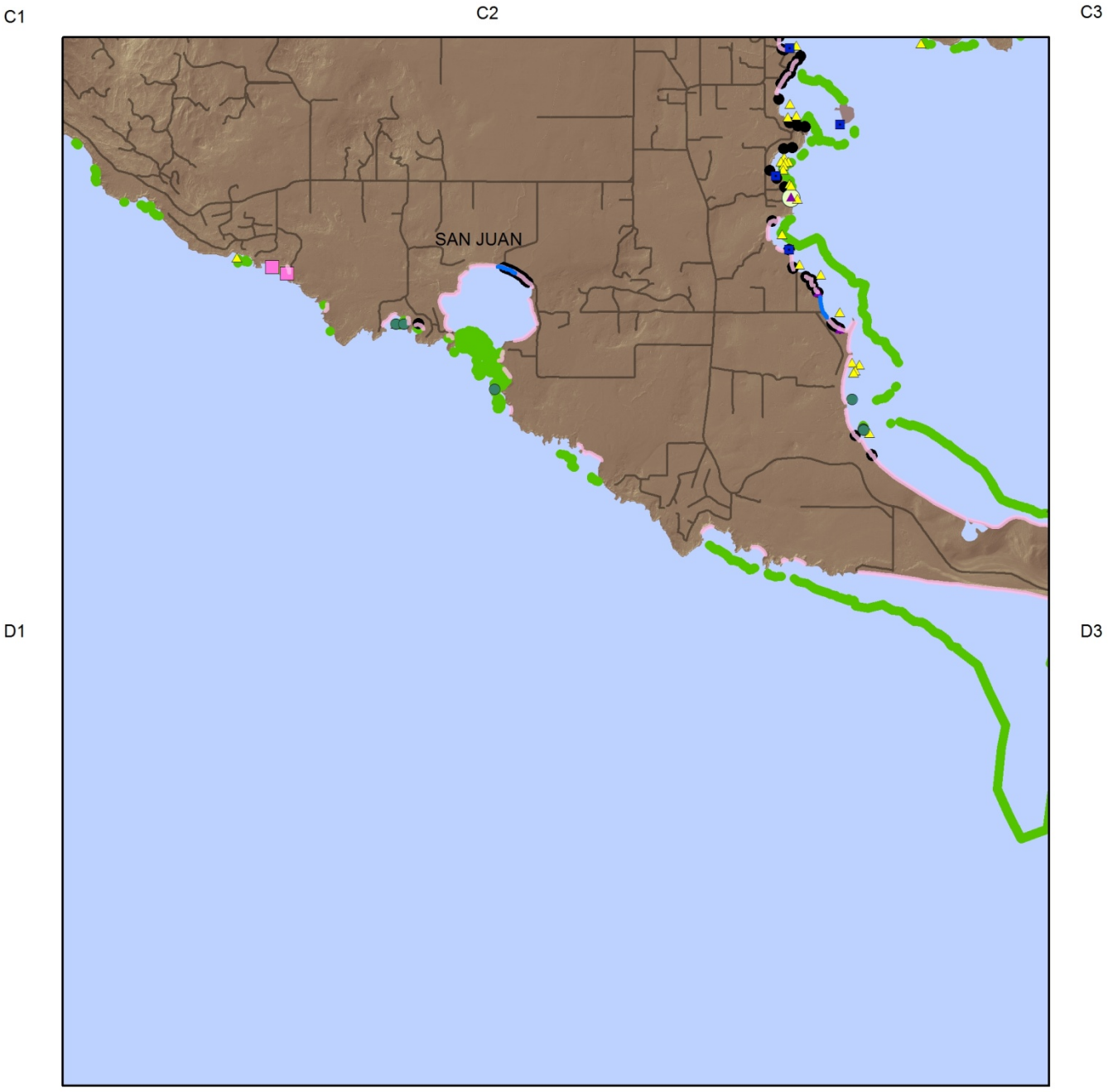
D1

FRIENDS OF THE SAN JUANS

San Juan County Shoreline
MODIFICATION INVENTORY



N

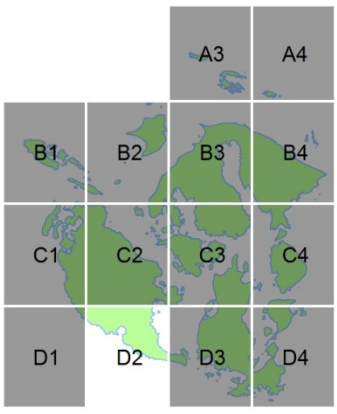
1 0.5 0 1 Miles

Legend

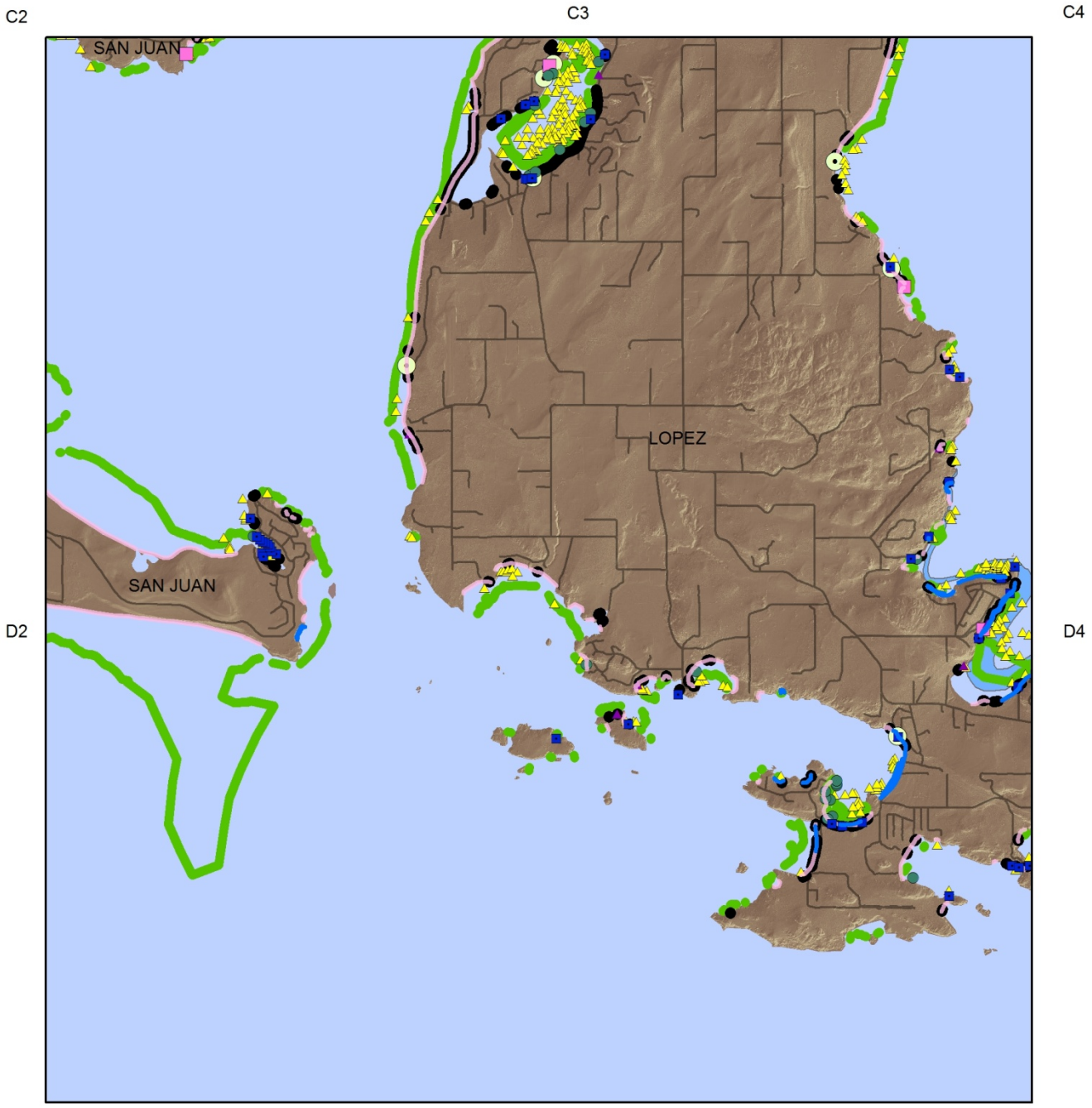
- Armoring
- Improved Boat Ramp
- Marine Railway
- Mooring Buoy
- Dock
- Groin
- Pilings
- Roads
- Known Forage Fish Spawn Habitat
- Potential Forage Fish Spawn Habitat
- Deep Water Edge Eelgrass
- Herring Spawning Grounds

D2

FRIENDS OF THE SAN JUANS



San Juan County Shoreline
MODIFICATION INVENTORY



Legend

- Armoring
- Improved Boat Ramp
- Marine Railway
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- Dock
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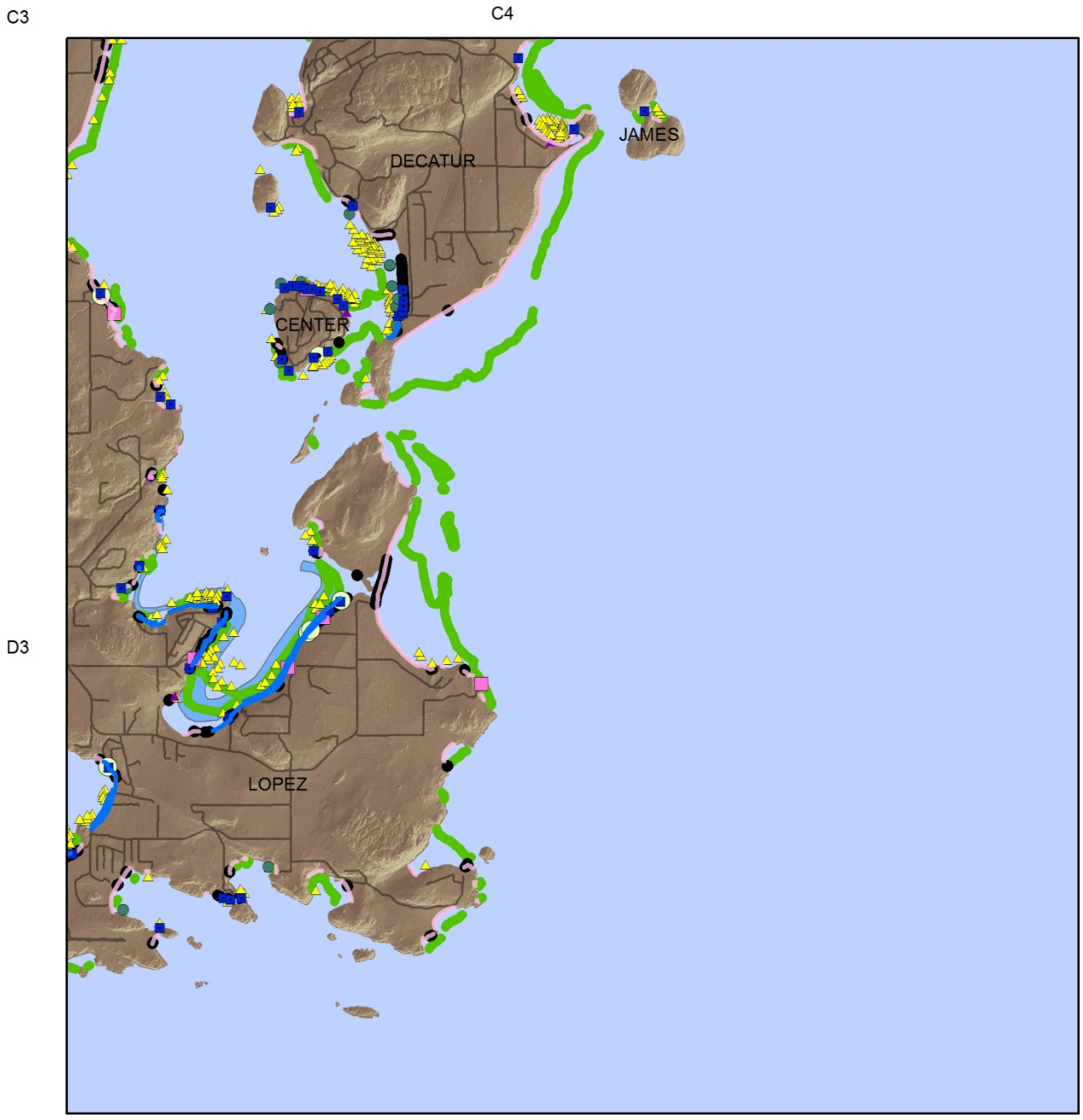
- Potential Forage Fish Spawn Habitat
- Deep Water Edge Eelgrass
- Herring Spawning Grounds

D3

FRIENDS OF THE SAN JUANS

San Juan County Shoreline
MODIFICATION INVENTORY



N

1 0.5 0 1 Miles

Legend

- Armoring
- Improved Boat Ramp
- Marine Railway
- Mooring Buoy
- Dock
- Groin
- Pilings
- Roads
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D4

FRIENDS OF THE SAN JUANS