ENS OCA-ORA FRAMEWORK REVIEW

23 June 2020

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OVERVIEW

- Purpose
- PDT Objectives
- Framework
    - Condition
    - Probability of Failure
    - Consequence
    - Output
- Existing Systems
- Reporting Tools
- Workflow
- Roadmap

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PURPOSE

Boundary features are USACE assets and as such shall be evaluated for condition and risks (Policy Memorandum, 10 May 2019)

- Track components and their conditions

- Use of hierarchical component lists

- Common, consistent, repeatable process

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PDT OBJECTIVES

- Identify boundary components

- Review applicable data standards

- Evaluate existing technologies

- Review existing policies

- Perform WCC analysis

- Develop condition-consequence index framework

- Develop method for integration index output into budget processes

- Draft implementation guidance

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WCC ANALYSIS

61454: Boundary Inspection and Maintenance

	FY 17 Budget*						FY 18 Budget*						FY 19 Budget*						FY 20 Budget*					
	In - Count of Packages	In-Capability	Not In-Count of Packages	Not In-Capability	Total - Count of Packages	Total - Capability	In - Count of Packages	In-Capability	Not In-Count of Packages	Not In-Capability	Total - Count of Packages	Total - Capability	In - Count of Packages	In-Capability	Not In-Count of Packages	Not In-Capability	Total - Count of Packages	Total - Capability	In - Count of Packages	In-Capability	Not In-Count of Packages	Not In-Capability	Total - Count of Packages	Total - Capability
LRD	94	$1,708,000	10	$536,000	104	$2,244,000	109	$2,208,500	0	$0	109	$2,208,500	83	$2,635,000	3	$238,000	86	$2,873,000	121	$3,869,000	0	$0	121	$3,869,000
MVD	33	$818,000	5	$483,000	38	$1,301,000	38	$1,236,000	2	$130,000	40	$1,366,000	44	$1,641,000	3	$195,000	47	$1,836,000	47	$1,641,000	2	$200,000	49	$1,841,000
NAD	50	$728,000	3	$75,000	53	$803,000	35	$777,000	0	$0	35	$777,000	39	$1,064,800	0	$0	39	$1,064,800	36	$1,032,000	0	$0	36	$1,032,000
NWD	64	$1,090,000	10	$1,358,000	74	$2,448,000	55	$756,000	1	$47,000	56	$803,000	52	$834,000	10	$365,000	62	$1,199,000	64	$1,165,000	0	$0	64	$1,165,000
POD	1	$60,000	0	$0	1	$60,000	1	$45,000	0	$0	1	$45,000	1	$40,000	0	$0	1	$40,000	1	$25,000	0	$0	1	$25,000
SAD	28	$1,400,000	0	$0	28	$1,400,000	23	$1,939,000	0	$0	23	$1,939,000	20	$1,490,000	1	$175,000	21	$1,665,000	27	$2,427,000	0	$0	27	$2,427,000
SPD	7	$130,000	1	$60,000	8	$190,000	1	$19,000	0	$0	1	$19,000	6	$105,000	0	$0	6	$105,000	18	$1,802,000	0	$0	18	$1,802,000
SWD	102	$1,857,000	21	$1,158,000	123	$3,015,000	93	$2,594,000	1	$210,000	94	$2,804,000	83	$2,702,000	16	$2,900,000	99	$5,602,000	108	$6,240,000	2	$165,000	110	$6,405,000
Sum	379	$7,791,000	50	$3,670,000	429	$11,461,000	355	$9,574,500	4	$387,000	359	$9,961,500	328	$10,511,800	33	$3,873,000	361	$14,384,800	422	$18,201,000	4	$365,000	426	$18,566,000

61453: Boundary Surveying and Rectification

	FY 17 Budget*						FY 18 Budget*						FY 19 Budget*						FY 20 Budget*					
	In - Count of Packages	In-Capability	Not In-Count of Packages	Not In-Capability	Total - Count of Packages	Total - Capability	In - Count of Packages	In-Capability	Not In-Count of Packages	Not In-Capability	Total - Count of Packages	Total - Capability	In - Count of Packages	In-Capability	Not In-Count of Packages	Not In-Capability	Total - Count of Packages	Total - Capability	In - Count of Packages	In-Capability	Not In-Count of Packages	Not In-Capability	Total - Count of Packages	Total - Capability
LRD	19	$685,000	4	$103,000	23	$788,000	22	$764,000	1	$1,900,000	23	$2,664,000	12	$1,269,000	2	$34,000	14	$1,303,000	14	$1,125,000	0	$0	14	$1,125,000
MVD	14	$609,000	4	$248,000	18	$857,000	18	$809,000	0	$0	18	$809,000	13	$791,000	0	$0	13	$791,000	10	$894,000	2	$175,000	12	$1,069,000
NAD	13	$205,000	0	$0	13	$205,000	7	$131,000	0	$0	7	$131,000	5	$76,000	0	$0	5	$76,000	1	$26,000	0	$0	1	$26,000
NWD	4	$39,000	1	$11,000	5	$50,000	6	$133,000	0	$0	6	$133,000	7	$141,000	6	$300,000	13	$441,000	12	$392,000	1	$130,000	13	$522,000
POD		$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0
SAD	7	$729,000	0	$0	7	$729,000	10	$1,074,000	0	$0	10	$1,074,000	3	$247,000	0	$0	3	$247,000	4	$426,000	0	$0	4	$426,000
SPD	9	$755,000	0	$0	9	$755,000	8	$386,000	0	$0	8	$386,000	7	$640,000	1	$550,000	8	$1,190,000	7	$672,000	0	$0	7	$672,000
SWD	8	$412,000	5	$637,000	13	$1,049,000	13	$735,000	2	$330,000	15	$1,065,000	13	$1,141,000	6	$552,000	19	$1,693,000	28	$1,615,000	2	$404,000	30	$2,019,000
Sum	74	$3,434,000	14	$999,000	88	$4,433,000	84	$4,032,000	3	$2,230,000	87	$6,262,000	60	$4,305,000	15	$1,436,000	75	$5,741,000	76	$5,150,000	5	$709,000	81	$5,859,000

61452: Resolution of Real Estate Encroachments

	FY 17 Budget*						FY 18 Budget*						FY 19 Budget*						FY 20 Budget*					
	In - Count of Packages	In-Capability	Not In-Count of Packages	Not In-Capability	Total - Count of Packages	Total - Capability	In - Count of Packages	In-Capability	Not In-Count of Packages	Not In-Capability	Total - Count of Packages	Total - Capability	In - Count of Packages	In-Capability	Not In-Count of Packages	Not In-Capability	Total - Count of Packages	Total - Capability	In - Count of Packages	In-Capability	Not In-Count of Packages	Not In-Capability	Total - Count of Packages	Total - Capability
LRD	26	$661,000	6	$1,156,000	32	$1,817,000	31	$1,256,600	0	$0	31	$1,256,600	22	$504,000	0	$0	22	$504,000	14	$527,000	0	$0	14	$527,000
MVD	12	$172,000	4	$675,000	16	$847,000	14	$380,000	1	$500,000	15	$880,000	15	$435,000	2	$150,000	17	$1,085,000	14	$475,000	2	$550,000	16	$1,025,000
NAD	21	$205,000	0	$0	21	$205,000	15	$143,000	0	$0	15	$143,000	17	$230,000	0	$0	17	$230,000	6	$118,000	0	$0	6	$118,000
NWD	34	$258,000	1	$240,000	35	$498,000	28	$174,000	0	$0	28	$174,000	26	$219,000	3	$12,000	29	$231,000	22	$197,000	0	$0	22	$197,000
POD	2	$40,000	0	$0	2	$40,000	1	$30,000	0	$0	1	$30,000	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0
SAD	18	$628,000	0	$0	18	$628,000	16	$876,000	0	$0	16	$876,000	19	$791,000	0	$0	19	$791,000	17	$689,000	0	$0	17	$689,000
SPD	5	$64,000	0	$0	5	$64,000	5	$206,000	0	$0	5	$206,000	2	$20,000	0	$0	2	$20,000	1	$55,000	1	$140,000	2	$195,000
SWD	49	$691,000	2	$160,000	51	$851,000	50	$1,308,000	0	$0	50	$1,308,000	45	$1,090,000	5	$608,000	50	$1,698,000	40	$1,552,000	2	$323,000	42	$1,875,000
Sum	167	$2,719,000	13	$2,231,000	180	$4,950,000	160	$4,373,600	1	$500,000	161	$4,873,600	146	$3,289,000	10	$770,000	156	$4,559,000	114	$3,613,000	5	$1,013,000	119	$4,626,000

*In-capability refers to packages that received funding for each FY

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INDEX FRAMEWORK

Comprised of:

- Metrics to measure condition of boundary as an asset
- Probability of failure (new encroachments occurring)
- Consequences of failure

Relative Risk Ranking Matrix For All Business Lines

Apply probability of failure

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INDEX FRAMEWORK – CONDITION

Condition scores by WCC

61452

- Encroachments recorded in REMIS
- Newly identified encroachments to be added to REMIS

61453

- Percent of monuments in USMART
- Percent of monuments in poor condition
- Percent of monuments that are missing

61454

- Percent of fee boundary inspected in previous FY
- Percent of boundary maintained in previous FY

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INDEX FRAMEWORK – CONDITION

Each condition metric at each project is scored against a set of A-F grading criteria

Internal Condition Scoring Metrics	Consequence Scoring Formulas					
	A (upper)	A (lower)	B (lower)	C (lower)	D (lower)	F (lower)
Percent of Monuments in DOR (UMSART)	100	100	80	70	60	0
Percent of Monuments in Degraded Condition (USMART)	0	4	10	15	20	100
Percent of Missing Monuments in FY19 (NRM Assessment)	0	4	5	10	15	100
Percent Fee Boundary Inspected in FY19 (NRM Assessment)	100	34	30	25	20	0
Percent Fee Boundary Maintained in FY19 (NRM Assessment)	100	34	30	25	20	0
Encroachments to be Entered into REMIS (NRM Assessment)	0	1	5	10	20	484
FY18-19 All Encroachments (REMIS)	0	1	5	10	20	902

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INDEX FRAMEWORK – CONDITION

Other considerations include:

- Boundary length
  - *Relative Project size*
  - *Amount of effort to inspect with regularity*
- Shoreline management program
- Adjacent agricultural land use
  - *Unauthorized row crops and grazing on fee land*
- State survey systems
  - *The ability to place/replace monuments and log in USMART*
- Boundary certification
  - *Records to support encroachment resolution, monumentation and signage*

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INDEX FRAMEWORK – PROBABILITY OF FAILURE

The likelihood that a higher than average number of new encroachments will occur

Factors included in analysis:

- Count of adjacent structures (NSI dataset)
- Count of total land based use permits (NRM inventory)

	Permit 1st Quintile	Permit 2nd Quintile	Permit 3rd Quintile	Permit 4th Quintile	Permit 5th Quintile
NSI 5th Quintile	Decrease score up to 20%	Decrease score up to 20%	Decrease score up to 20%	Decrease score up to 20%	Decrease score up to 25%
NSI 4th Quintile	Decrease score up to 10%	Decrease score up to 10%	Decrease score up to 10%	Decrease score up to 10%	Decrease score up to 20%
NSI 3rd Quintile	Decrease score 0%	Decrease score 0%	Decrease score 0%	Decrease score up to 10%	Decrease score up to 20%
NSI 2nd Quintile	Decrease score 0%	Decrease score 0%	Decrease score 0%	Decrease score up to 10%	Decrease score up to 20%
NSI 1st Quintile	Decrease score 0%	Decrease score 0%	Decrease score 0%	Decrease score 10%	Decrease score up to 20%

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INDEX FRAMEWORK – PROBABILITY OF FAILURE

Observations based on available data

- **42.6%** of new encroachments in FY19 were identified at **15 Projects**
- **68.4%** of new encroachments in FY19 were identified at Projects in the top 40% by count of land based use permits
- **62.5%** of new encroachments in FY19 were identified at Projects in the top 40% by count of adjacent structures

New Encroachments per Project

Land Based Use Permit Quintiles

	0 count	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile	Total
0 count	2.08	2.00	0.00	0.00	8.00	60.67	4.50
1st Quintile	0.15	0.00	0.00	0.00	0.00	0.00	0.15
2nd Quintile	0.25	0.00	1.00	0.00	0.00	0.00	0.26
3rd Quintile	1.50	2.67	0.00	0.33	6.50	0.00	1.52
4th Quintile	0.50	0.00	0.43	2.43	3.00	0.00	0.76
5th Quintile	2.86	6.00	2.60	5.00	9.67	37.00	12.83
Total	1.07	2.21	0.94	2.26	8.11	40.94	3.39

NSI Quintiles

INDEX FRAMEWORK – OCA

Project WCC condition scores (A-F)

- Score each metric for a given WCC in proportion to A-F grading thresholds
- Apply weight (currently using equal weighting scheme)
- Add weighted metric scores
- Divide sum of weighted metric scores by total possible score
- Plot on 0-1 condition axis

Probability of failure (0-25%)

- Score both NSI and permits in proportion to the 4th and 5th quintiles for each dataset
- Depending on each value within each quintile, there is a minimum to maximum probability of failure percent range that can be applied to a Project condition score

OCA score (A-F) = condition score - probability of failure

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INDEX FRAMEWORK – CONSEQUENCE

Metrics used to indicate the **operational** and **environmental** significance of the Project land protected by the boundary

- Consequence index of "I-V"
  - "I" = highest consequence, "V" = lowest consequence

- Count of authorized Project purposes at the Project
  - 3 results in a consequence score of at least "III"
  - >3 results in a consequence index score of at least "II"

- Boundary management is performed to protect operations

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INDEX FRAMEWORK – CONSEQUENCE

Environmental significance metrics include:

- Acres of priority conservation areas on fee land
- Percent of fee land overlapping with priority conservation areas
  - Priority conservation areas delineated by The Nature Conservancy

- Count of federally listed special status species

- Percent of fee land that is part of natural corridor land cover
  - Areas identified by Morphological Spatial Pattern Analysis (MSPA)
  - Derived from NLCD raster data
  - Made available by US EPA

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INDEX FRAMEWORK – CONSEQUENCE

INPUT: binary map

- ■ Foreground: objects of interest
- □ Background: complementary area
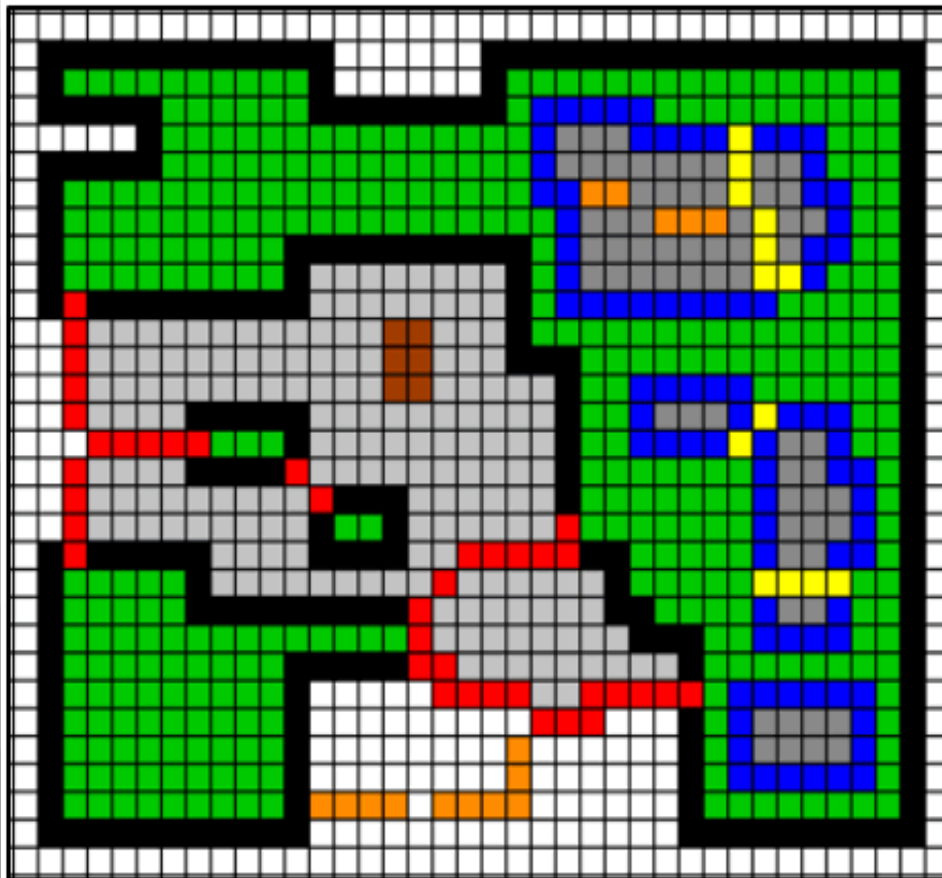
MSPA foreground classes

- ■ Core: interior area excluding perimeter
- ■ Islet: disjoint and too small to contain Core
- ■ Loop: connected to the <u>same Core</u> area
- ■ Bridge: connected to <u>different Core</u> areas
- ■ Perforation: internal object perimeter
- ■ Edge: external object perimeter
- ■ Branch: connected at one end to Edge, Perforation, Bridge, or Loop.

MSPA background classes

- □ Background
- ■ Border-Opening: along Edge
- ■ Core-Opening: within Perforation

INDEX FRAMEWORK - CONSEQUENCE

- Individual consequence metrics are scored based on their value within the upper and lower bounds of quintiles of the entire dataset.

- Metric weights are applied

- Weighted metric scores are added together

- The sum of these scores is divided by the maximum total score possible
  - Resulting in a value on a scale between 0 and 1.

- The weighted score sum is compared to the minimum threshold metrics:
  - The count of authorized Project purposes
  - Whether a project has a shoreline management program

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INDEX FRAMEWORK – CONSEQUENCE

Acres TNC Priority Conservation Areas (TNC)	136859	11794	3247	1126	323	0
Percent TNC Priority Conservation Areas (TNC)	100%	93%	57%	31%	8%	0%
Special Status Species	18	7	3	2	1	0
Percent Connectivity Matrix (MSPA)	100%	90%	82%	70%	49%	0%

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INDEX FRAMEWORK – ORA

- Operational Risk Assessment accounts for an asset's condition, probability of failure (OCA) AND consequences of failure

- Combine condition index and consequence index on a 5x5 matrix

- This combination will yield a 1-25 score

INDEX FRAMEWORK – DEMO

- Demonstrate ENS Boundary OCA Workbook
- Report Project scores based on draft framework
- Calculate the delta produced by work packages

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EXISTING DATA SYSTEMS

This OCA-ORA relies heavily on existing systems developed and maintained by USACE:

- USMART
  - Monuments and their physical condition
- REMIS
  - Count of encroachments
- NRM Assessment
  - Estimation of missing monuments
  - Boundary miles inspected and maintained
  - Newly identified encroachments not yet in REMIS
  - SMP and land use permits
  - Special status species
- National Structure Inventory (HEC)

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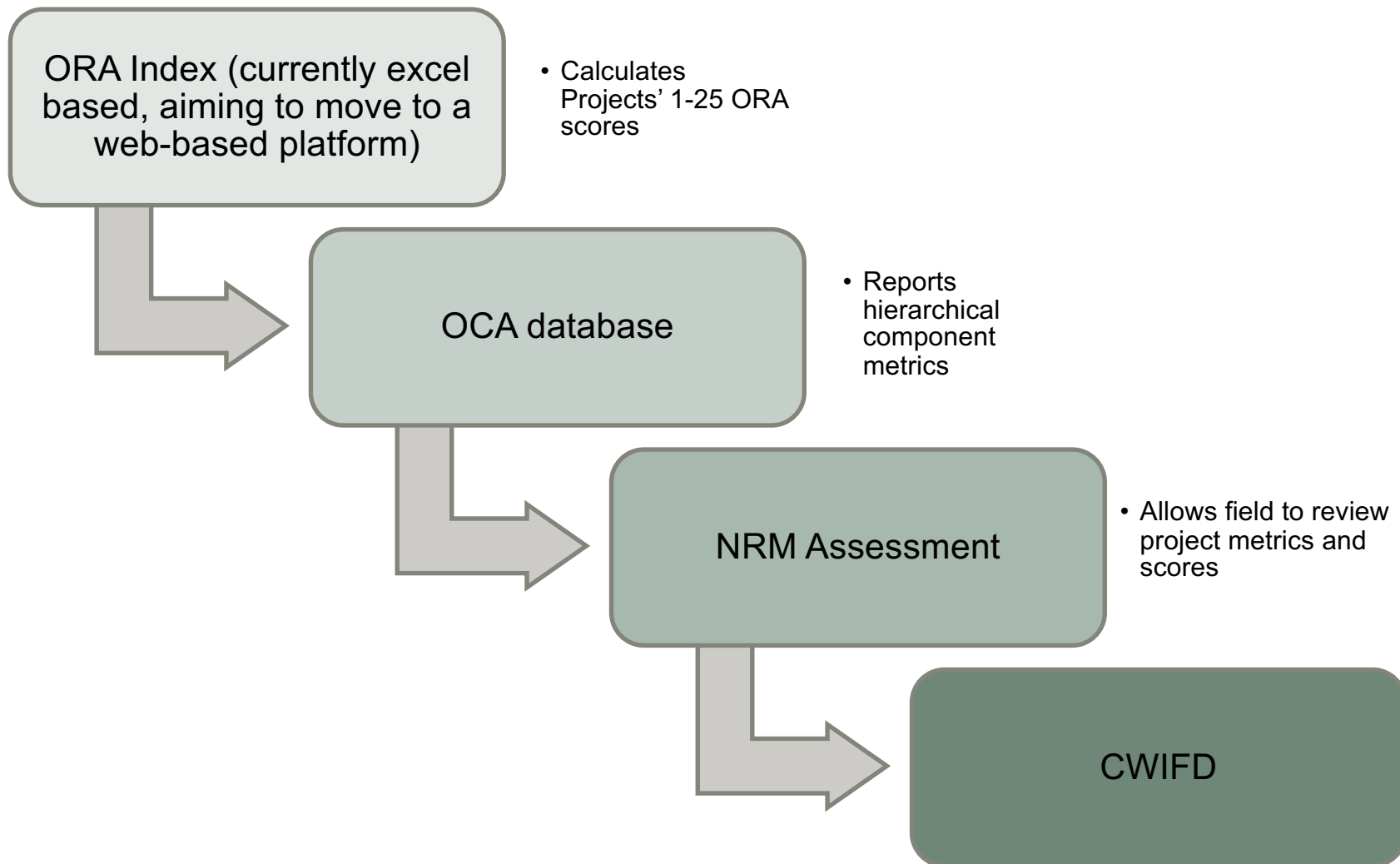U.S.ARMY

REPORTING TOOLS – GIS

An additional objective of this PDT is to evaluate existing technology and develop methods to improve data quality

Currently, there is no SOP for NRM O&M staff to utilize or develop a nationally consistent method for **mapping boundary miles inspected and maintained, note missing monuments, and to log potential encroachments or other issues** in a way that integrates with this framework

This PDT is researching the potential to develop an AGOL Partners Portal where relevant spatial data may be retrieved and updated based on SDSFIE standards

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WORKFLOW

ORA Index (currently excel based, aiming to move to a web-based platform)

- Calculates Projects' 1-25 ORA scores

OCA database

- Reports hierarchical component metrics

NRM Assessment

- Allows field to review project metrics and scores

CWIFD

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ROADMAP

June 2019 – PDT Kick-off meeting at Grapevine Lake, SWF

November 2019 – PDT index development meeting at Rend Lake, MVS. Demo ArcCollector with preloaded data

March 2020 – PDT index finalization meeting ~~Old Hickory Lake, LRN~~ virtual meeting

May 2020 – Submit draft framework and guide to AM

May 2020 – Test framework delta calculations on FY22 work packages

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ROADMAP

Summer 2020 – CoP review: NRM, AM, RE, GIS, Survey

Summer/Fall 2020 – Continue development of reporting tools

Summer/Fall 2020 – Identify improvements for index integration into existing budget processes

Fall 2020 – Revise index framework and policy to reflect improvements identified from CoP review, budget integration, and tool development

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DISCUSSION