Jacobs

Memorandum

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Subject	**Foundational Element Memorandum #2 - Metrics for Assessing Stream Health Improvements**	**Project Name**	City of Bellevue Watershed Management Plan
Attention	Jerry Shuster, City of Bellevue		
From	Amy Carlson (Jacobs)		
Date	February 18, 2021		
Copies to	**John Lenth (Herrera), Brian Landau (City of Bellevue)**		

Introduction

Urban development in the lowland regions of the Puget Sound basin over the past 150 years has resulted in the conversion of large tracts of forested area to residential, industrial, and commercial land uses. Changing environmental conditions that resulted from this conversion have dramatically impacted the health of the region's streams, lakes and marine water bodies. Common causes of water resource degradation from urbanization include poor water quality, loss of riparian and aquatic habitat, and stream channel erosion. In combination, these impacts have resulted in widespread disruption in the ecological function of water bodies causing sensitive aquatic life to decline in abundance or disappear completely. In response, water resources managers including those at the City of Bellevue (City) are identifying ways in which to protect, sustain, and improve these water bodies.

The City is committed to improving and protecting the aquatic health of its surface waters. To that end, the City is developing a Watershed Management Plan (WMP) that will focus on improving the health of the City's streams by using a toolbox of holistic storm and surface water management practices. The WMP will direct investments to high-priority watersheds providing measurable environmental benefits to stream health within a shorter time frame than past or current approaches. The WMP will also help prevent further degradation in non-priority watersheds. The WMP will include an implementation plan with recommended projects, policies, programs, and operational plans to meet performance goals for Bellevue's streams, and to provide multiple benefits that help advance City objectives across departments and programs.

The City is developing the WMP using a stepwise process that builds on information obtained from each proceeding step to ensure the final plan is comprehensive, makes the most use of new and existing data and information, and reflects the community's values and goals. As shown in Figure 1, this stepwise process leading up to WMP development includes the following major components:

- **Foundational Element Memoranda** will be prepared at the onset of WMP development to define critical inputs to the process including the overarching framework for the plan (Foundational Element #1), the metrics that will be used to assess stream health improvement (Foundational

Element #2, this memorandum), and the approach that will be used for prioritizing watersheds (Foundational Element #3). Foundational elements may also include a policy review and with recommended additions/changes and a regulatory strategy.

- **Watershed Assessment (WA) Reports** will be developed to characterize existing conditions in the City's watersheds: greater Kelsey Creek, Coal Creek, the grouping of small Lake Washington sub-basins, and the grouping of small Lake Sammamish sub-basins (including Lewis Creek). Each WA will include limiting factors, data gaps (if any), and identified opportunities for improving watershed health.
- **A Watershed Management Toolbox** will be prepared to identify and document the different tools (or strategies) that could be used to meet the WMP goals. These could include stormwater Best Management Practices (BMPs), policy/regulatory changes, operational strategies, engineered solutions, management strategies, etc. The toolbox will also indicate which stressors on stream health are addressed by each individual tool or management strategy.
- **Initial and revised Watershed Prioritizations** will be performed to identify which watersheds would have the quickest positive response to rehabilitation efforts, with the goal of maximizing return on the City's investments in stream health. The initial prioritization (performed before and during WA development) will provide the technical basis for meeting regulatory requirements for watershed planning that stem from the City's Phase II Municipal Stormwater Permit (Phase II Permit). The revised prioritization (performed after the WAs are complete) will include community input and guide all subsequent phases of WMP development.
- **Community Metrics** will be identified based on community values and goals for quantifying additional benefits that may be realized from the WMP in addition to those related to improved stream health. These metrics will be formed during a robust public engagement process. For example, these metrics might quantify benefits from the plan related to increased access to open space, educational opportunities, enhanced aesthetics, and/or environmental and social justice issues. (The process of developing, and the use of, these community metrics is discussed further in this memorandum.)
- **Watershed Improvement Plans (WIPs)** will be prepared for each priority watershed that list and describe each of the solutions recommended for watershed improvement with associated costs and a schedule for implementation. These plans will provide details on the tools and opportunities considered for watershed improvement, provide information on how the opportunities were evaluated, and the results of those evaluations. The WIPs will focus on investments to improve stream health rather than broader community goals, which will be addressed in the WMP itself.

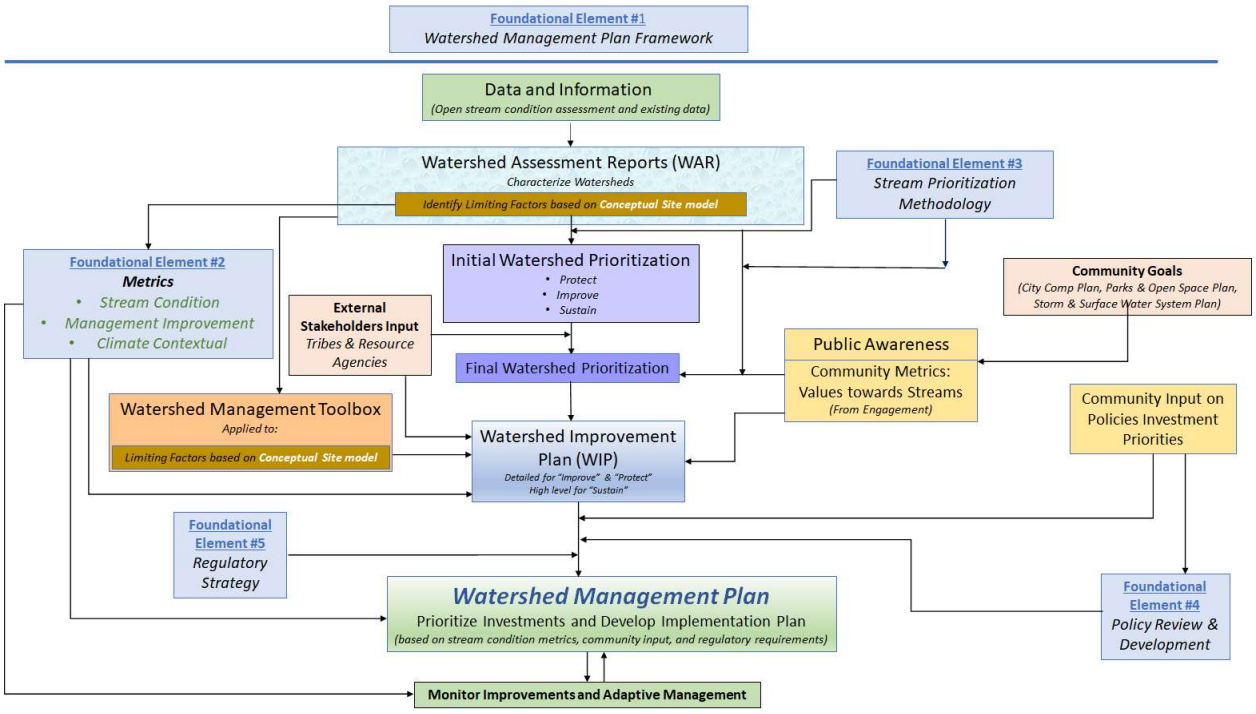


Figure 1 – Watershed Management Plan Development Process

All the work performed to develop these components of the WMP will be informed by a conceptual model (Figure 2) the City has developed that describes the primary effects of urban runoff on stream health. This model shows the linkages between specific sources of stress on stream health (e.g. stormwater runoff) and the consequences, impacts, and outcomes that collectively contribute to degraded stream health. This model will be particularly important for identifying the specific limiting factors that are responsible for impaired stream health during preparation of the WAs and the appropriate solutions for improving conditions during preparation of the WIPs.

Purpose

The purpose of metrics is to have a means to measure (and quantify) the progress towards meeting stream health goals. This Foundational Element #2 memorandum describes the type of metrics developed and includes a description of how and when the metrics will be used during WMP development and as part of Adaptive Management after WMP completion. This memorandum is organized into the following subsections:

- Process to Develop Metrics
- Types of Metrics – Stream Condition Metrics, Management Improvement Metrics, Contextual Climate Metrics, and Community Metrics
- When and How Metrics will be Used in Watershed Management Planning
- Next Steps

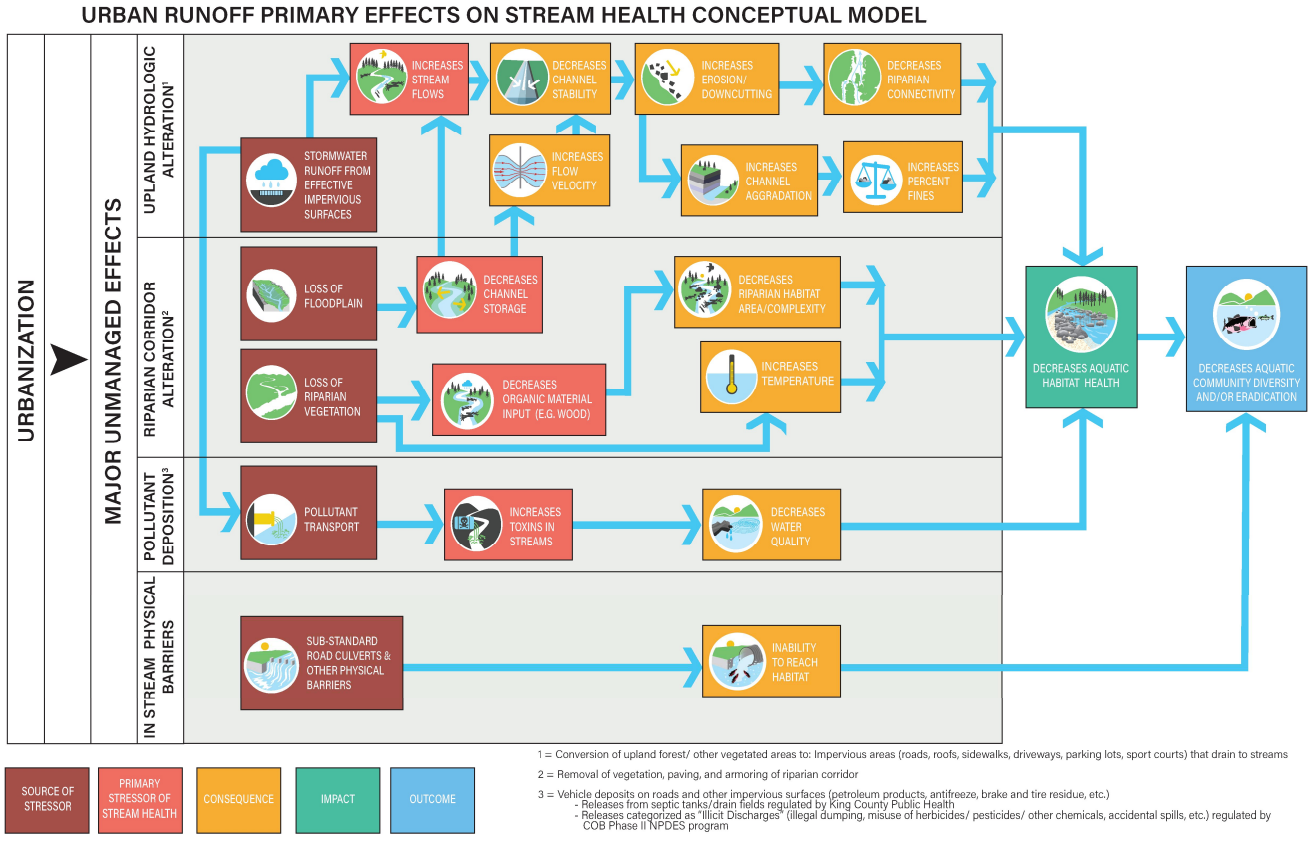


Figure 2 – Conceptual Model Describing the Primary Effects of Urban Runoff on Stream Health

Process to Develop Metrics

The City and Consultant team discussed metrics in a series of workshops, including WMP Workshop #5 on 12/2/19 and Workshop #6 on 1/9/20. (Meeting summaries from these workshops are included in Appendix A.)

As a first step in developing and selecting metrics, workshop participants considered:

- Is the data needed for the metric (relatively) straightforward to obtain, and is it measurable?
- Does the City have the ability to affect this metric?
- Is this metric robust enough to detect improving conditions out of other random environmental "noise" that may mask this signal?
- What is the variability of the metric (as compared to how often it can be measured)?
- What is the response time of the metric? (how soon might a change be detected?)

The next step in developing metrics was to define what it is the WMP is trying to achieve. The goal of the City's WMP is to improve the health of the City's streams. To achieve that outcome, investments to improve stream health must address the major unmanaged effects of urbanization identified in the City's Conceptual Model (Figure 2): in stream physical barriers, pollutant deposition, riparian corridor alteration, and upland hydrologic alteration. To be an appropriate means of measuring stream health for use in the City's WMP, metrics must align to one or more of these unmanaged effects and/or to the outcome (shown in blue on the right-most side of Figure 2): decreases aquatic community diversity and/or eradication.

After much discussion and review, the team developed the following set of ten (10) metrics to be used to characterize stream condition (with more detail provided in Appendix B):

- **Stream flow** – volumetric flow rate, with lower peak flows causing less erosion than higher peak flows
- **Substrate composition** – relative size of material in stream bed, recognizing preference of spawning salmonids for spawning
- **Stream pools** – locations of deeper, often lower-velocity, water, providing habitat
- **Stream wood –** locations of downed trees in and proximate to stream, providing habitat
- **Riparian canopy vegetation** – tree canopy coverage within a certain distance from stream reduces stream temperature and also provides habitat (and future stream wood)
- **Stream temperature** – lower stream temperature is better for habitat
- **Periphyton** – measure of presence of periphyton is surrogate for pollutant deposition
- **Benthic macroinvertebrates** – 'stream bugs' present in a stream indicate relative health of stream
- **Resident fish** – non-anadromous fish presence, measure of habitat
- **Salmon presence** – presence of salmonids, measure of habitat and other factors

To verify the set of stream condition metrics, the team confirmed that each of the four major unmanaged effects in the Conceptual Model were addressed by one or more metrics (with the benthic macroinvertebrates metric covering all four effects), noting that some metrics apply to more than one unmanaged effect (Table 2).

Table 2 Alignment of Stream Condition Metrics to Unmanaged Effects of the Conceptual Model

Unmanaged Effect from Conceptual Model (Figure 2)	Stream Condition Metrics
In-stream physical barriers	Salmon presence, resident fish, substrate composition
Pollutant deposition	Periphyton, stream temperature
Riparian corridor alteration	Stream pools, stream wood, riparian canopy vegetation, sediment composition
Upland hydrologic alteration	Stream flow, substrate composition

Workshop participants noted the desire to have metrics for the overall tracking of the investments made in improving stream health (such as adding more water quality treatment or reducing total impervious surface), and a desire to have and metrics to help provide climate context for the other metrics (such as ambient temperature). These management improvement metrics and contextual climate metrics, respectively, are described in the next section of this memorandum, as are community metrics.

Types of Metrics – Stream Condition Metrics, Management Improvement Metrics, Contextual Climate Metrics, and Community Metrics

Stream condition metrics noted in the previous section of this memorandum will be used to measure the stream health improvements of the City's WMP. In addition, the City also intends to track the overall effect of individual investments made. For example, the City will want to know how much of a reduction in impervious surface was achieved or how much total area receives water quality treatment, as these activities help achieve the outcomes of improved stream health. Management Improvement metrics were developed for this purpose. Also, the City will track Contextual Climate Metrics to provide context to the other metrics (for example, ambient air temperature and precipitation). Table 1 shows Stream Condition Metrics, Management Improvement Metrics, and Contextual Climate Metrics developed for use in WMP development. Details are included in Appendix B.

Once the sets of Stream Condition Metrics, Management Improvement Metrics, and Contextual Climate Metrics were developed, the Team documented whether or not the data needed is already being collected by the City. In addition, units of measurement were identified as well as the methods of data collection (field measurement and/or desktop data collection). This is also shown in Table 1.

Table 1 Stream Condition Metrics, Management Improvement Metrics, and Contextual Climate Metrics

Type	Metric	currently collected by the City?	Units	How collected?
Stream Condition Metrics (used to measure outcomes – to stream health)	stream flow	yes	Cubic feet per second (cubic feet per second), depth (feet)	field measurement
	substrate composition	yes	visual characterization	field measurement
	stream pools	yes	visual characterization	field measurement
	stream wood	yes	counts, size, location (buckets by class)	field measurement
	riparian canopy vegetation	yes (in City GIS)	acres or square feet	desktop
	stream temperature	no	degrees F or C	field measurement
	periphyton	no	plate density, counts	Field measurement and lab
	benthic macroinvertebrates	yes	BIBI index, sub-metrics within the BIBI index (to be decided)	field measurement
	resident fish	yes	abundance	field measurement
	salmon presence	yes	spawning surveys, presence of adults (to be decided)	field measurement

Type	Metric	currently collected by the City?	Units	How collected?
Management Improvement Metrics (used to measure overall improvement based on the individual actions taken to achieve outcomes)	riparian canopy vegetation	yes (in City GIS)	acres or square feet	desktop
	Impervious Surface	yes (in City GIS)	acres or percent (%)	desktop
	Structural Stormwater Controls	yes	number, type, acres/inches managed	desktop
	Accessible Stream Length and Barriers	no	Linear Feet	field and/or desktop
	Floodplain connectivity	yes (in City GIS)	acres available for channel migration	desktop
Contextual Climate Metrics (provides context to the other metrics)	Ambient Air Temperature	yes (by others)	degrees F or C	field
	Precipitation	yes (by others)	Inches	field

In addition to Stream Condition Metrics, Management Improvement Metrics, and Contextual Climate Metrics, Community Metrics will be developed. Community Metrics will be identified based on community values and goals for quantifying additional benefits that may be realized from the WMP in addition to those related to improved stream health. For example, these metrics might quantify benefits from the plan related to increased access to open space, educational opportunities, enhanced aesthetics, and/or environmental and social justice issues. The WMP team will coordinate with the City's Environmental Stewardship Initiative and the City's Comprehensive Planning efforts in the development of these Community Metrics.

When and How Metrics will be Used in Watershed Management Planning

Figure 1 shows graphically when the different sets of metrics (Stream Condition Metrics, Management Improvement Metrics, Contextual Climate Metrics, and Community Metrics) will be used throughout WMP development. This section of this memorandum describes in further detail when and how these metrics will be used.

Stream Condition Metrics and Management Improvement Metrics will not be used in the development of the Watershed Assessment (WA) Reports to identify limiting factors. Instead, limiting factors will be identified based on the source(s) of the stressors in the Conceptual Model (Figure 2). The Stream Condition Metrics and Management Improvement Metrics will be used first during Watershed Improvement Plan (WIP) development to define performance targets for watershed improvement. In the WIP for a particular watershed, not all Stream Condition Metrics may be utilized, as some may not be applicable. One of the first steps in WIP development is to identify which subset of Stream Condition Metrics is applicable to that watershed or sub-basin. Once that subset of Stream Condition Metrics is determined, a Performance Target will be determined for each Stream Condition Metric to be applied in that particular watershed depending on that watershed's limiting factors (assessed in the WA). A Performance Target is a numerical value which is the 'goal', or 'desired outcome' of the investments made. The Performance Target for a specific metric may vary between watersheds. For example, Coal Creek

might have a stream temperature performance standard lower than of Kelsey Creek, because of the limiting factors of each watershed.

In preparation of the WIPs, the Stream Condition Metrics and Management Improvement Metrics will be used to quantify and evaluate the potential benefits provided by each individual potential investment, allowing for a scoring and prioritized ranking of all potential investments in that watershed that is the topic of the WIP. Contextual Climate Metrics will be used to provide context throughout WIP development.

During the development of the WMP, WIPs from individual watersheds are brought forward into one single planning effort. These plans will also incorporate broader community goals, defined during an upcoming public engagement process, during their development. Stream Condition Metrics, Management Improvement Metrics, and Community Metrics will be used collectively to evaluate and prioritize all potential investments identified throughout the planning process to that date, with Contextual Climate Metrics continuing to provide context to the other metrics.

Lastly, the Stream Condition Metrics, Management Improvement Metrics, and Community Metrics (including associated Performance Targets) in each watershed will be used to evaluate progress towards meeting stream health goals as part of the WMP Adaptive Management Process. Performance will be tracked and reported, organized by these Metrics.

Next Steps

The following next steps are recommended with regards to metrics:

- **Determine specific units for each metric:** For those metrics that have more than one potential unit listed in Table 1, determine which unit (or units) is/are most applicable for this purpose.
- **Identify and address additional data needs:** Review all data needs for each stream condition and management improvement metric; Identify which metrics need field-collected data and develop a field data collection plan and applicable protocols and methods (ex: periphyton and stream temperature, see Table 1); Identify desktop data needs and GIS analysis needs and develop workplan for those activities, especially those that can commence immediately. Review and analyze Open Stream Condition Assessment data for use in this WMP. Develop Data Collection and Analysis Plan for all data/information needed for all metrics, regardless if additional data is needed (above and beyond current City level of activity).
- **Define which metrics will be used for each Watershed or Sub-Basin and Develop Performance Targets for each Metric**: Once the WA is complete for a particular watershed, identify which metrics will be used in throughout watershed. Set a numerical performance target for each metric in each watershed.
- **Specify the frequency and duration of measurements for each metric in each watershed:** need frequent enough measurements to quantify the variability in the data so the trend interest can be detected. The measurements must also be made over a sufficient duration to detect improving conditions relative to baseline. These factors will be considered to determine the frequency and duration of Open Channel Stream Assessments, and data collected as part of that effort for specific metrics (ex: substrate composition, stream pools, stream wood)

- **Prepare Adaptive Management Strategy:** After WAs and WIPs are complete, prepare an adaptive management strategy including a monitoring plan for how and when Stream Condition Metrics, Management Improvement Metrics, and Community Metrics will be used to assess performance; specify reporting methods and frequency; identify locations for optimum observation/results; determine frequency that metrics will be re-evaluated for alignment with goals; determine what happens if performance targets are not met (what strategies are then implemented)

Appendix A – Workshops #5 and #6 Meeting Notes

Appendix B – Details of Stream Condition Metrics, Management Improvement Metrics, and Contextual Climate Metrics

Appendix A – Workshops #5 and #6 Meeting Notes

MEETING SUMMARY

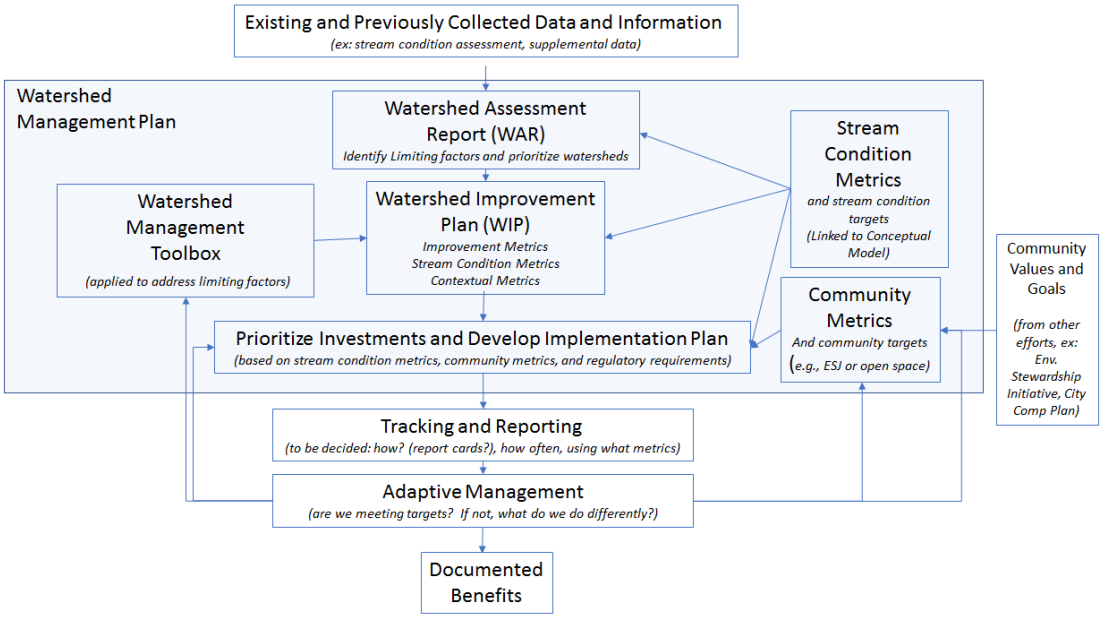
MEETING TITLE	Watershed Management Plan Continued Services - Workshop #5
DATE	1/9/2020
TIME	9am-12noon
LOCATION	CH-1E-118
ATTENDEES	Brian Landau, Kit Paulsen, Jerry Shuster, Don McQuilliams, Christa Heller, Amy Carlson (Jacobs), John Lenth (Herrera)

Introductions and Workshop Outcomes

- Goal of Watershed Management Plan: direct improvements to the health of Bellevue's streams
- Goal of this current phase of work (today through April 2020): continue on tasks/activities, tap institutional knowledge
- Goals of this Workshop #5:
    - Review/finalize implementation framework – how/when metrics are used, update shared vocabulary
    - Review/edit/finalize metrics
    - Discuss/finalize – data needed for each metric

Implementation Framework

- During the workshop, attendees edited the draft graphic; see below for updated graphic
- Three types of metrics:
    - Stream condition metrics (the benefit, our outcome, we are trying to achieve)
    - Improvement metrics (the actions we take, presuming it will help achieve the outcomes we want)
    - Contextual metrics (helps us understand the context of what's happening)
- Community Metrics will be included during WMP development to develop an implementation plan for the WMP; community metrics will come from other on-going efforts like ESI (Environmental Sustainability Initiative) and the City Comp Plan (TBD closer to time when these will be used – after the WIPs are complete)



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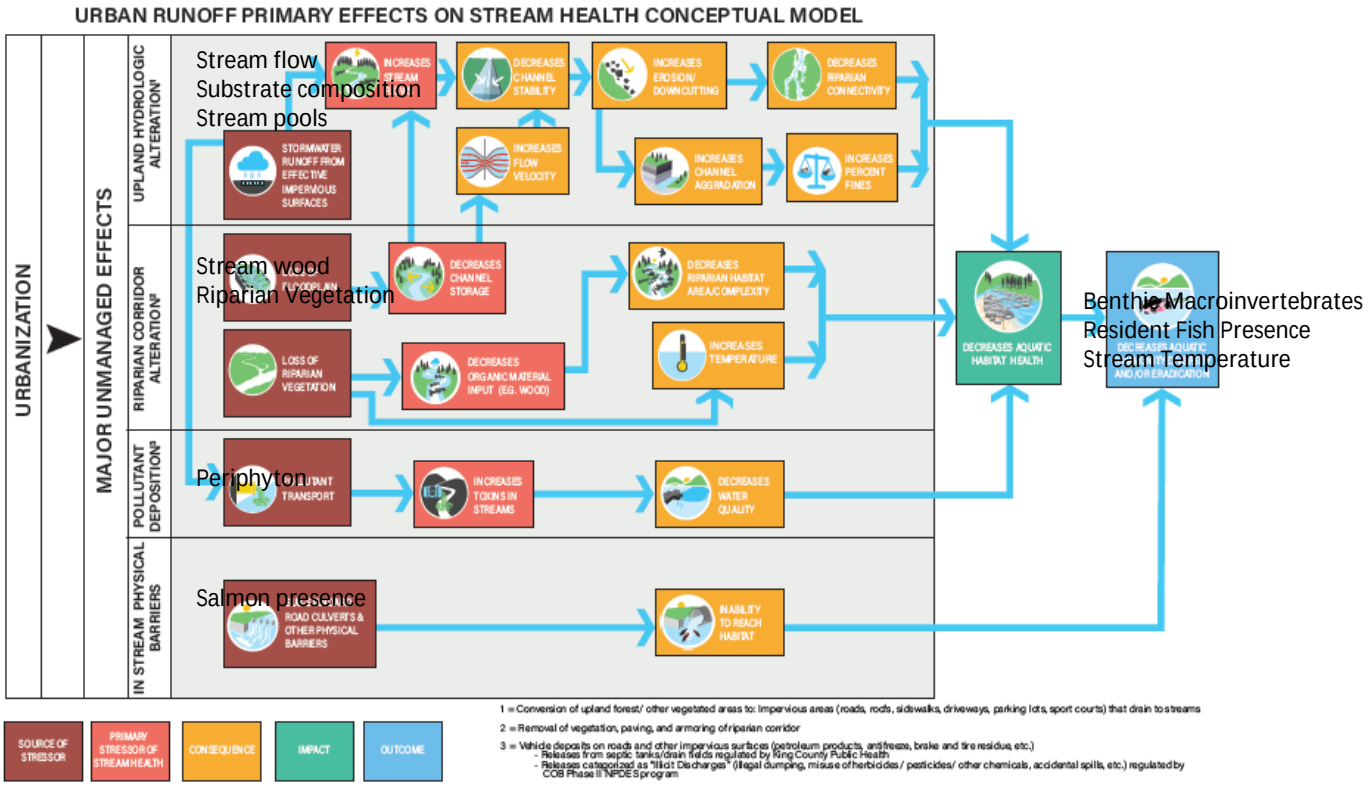
MEETING SUMMARY

Metrics

- Each of 26 sub-basins may:
  - Use only a sub-set of the stream condition metrics
  - have different numerical target for each metric (based on management strategy and limiting factors for that sub-basin)
- Three types of metrics:
  - Stream condition metrics (10) – stream flow, substrate composition, stream pools, stream wood, riparian vegetation, stream temperature, periphyton, benthic macroinvertebrates (stream bugs), resident fish presence, salmon presence
  - Improvement metrics (5, possibly more, with sub-metrics too) – riparian vegetation (units to be determined – see stream condition metric), impervious surface, structural stormwater controls, accessible stream length, floodplain connectivity,
  - Contextual metrics (2, possibly more) – ambient air temperature, precipitation
- Conceptual Model: need to now overlay the stream condition metrics onto the conceptual model, recognizing that many of the stream condition metrics apply to more than one of the major unmanaged effects (see below – only shows each metric in one 'bin', recognizing they might also show up in other 'bins')
- Model predicting pollutant loads from a subbasin as function of landuse – surrogate for water quality? Not a stream condition metric – Instead – make part of toolbox to identifying priority "hot spots"for stormwater management.
- Note; took off TSS/turbidity from list of stream condition metrics because of challenges getting samples and in having enough data to make it statistically meaningful inferences.
- Note: while invasive species are important to track, no metrics for invasive species have been included here; City to continue tracking mudsnails, etc., for other purposes



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MEETING SUMMARY

Data Collection Needs for Metrics

- Updated a draft table during the workshop – see below
- More work to do but this table represents a good working draft
- Need to add a column – how often would we get data on these? How often would we sample? How soon might we see a response?
- Note – open stream condition assessment – how often would the City do this? To be decided; every 10-15 years, and do we do all of it, or just a portion of it? For substrate composition, stream pools, and stream wood that are directly from the stream condition assessment, these might need to be collected more often for use in the WMP

			metric	currently collected?	Units	How collected?	Notes
Stream Condition Metrics	measuring outcomes, benefits	1	stream flow	yes	cfs, depth	field measurement	rating curves are good; should review historical data for pulse counts; might need to add monitoring gages
		2	substrate composition	yes	visual characterization	field measurement	part of open stream condition assessment
		3	stream pools	yes	visual characterization	field measurement	part of open stream condition assessment
		4	stream wood	yes	counts, size, location (buckets by class)	field measurement	part of open stream condition assessment
		5	riparian canopy vegetation	no	acres or square feet	desktop	TBD how - possibly take citywide tree canopy GIS information and 'clip' for within 100' of stream channel
		6	stream temperature	no	degrees F or C	field measurement	tidbits or else stream probe
		7	periphyton	no	plate density, counts	field measurement	appropriate to do at same time and locations and frequency as BIBI; do have 1 sample of diatoms
		8	benthic macroinvertebrates (stream bugs)	yes	BIBI index, sub-metrics within the BIBI index (TBD)	field measurement	no need to expand current sampling plan
		9	resident fish	yes	abundance,	field measurement	no need to expand current sampling plan
		10	salmon presence	yes	spawning surveys, presence of adults?	field measurement	no need to expand current sampling plan
Improvement Metrics	measuring what we are doing to get the outcomes we want?	1	riparian canopy vegetation	no	acres or square feet	desktop	TBD - do we need here if we have as a stream condition metric?
		2	Impervious Surface	yes	acres or %	desktop	TBD on total impervious surface, effective, PGIS, and/or treated PGIS
		3	Structural Stormwater Controls	yes	number, type, acres/inches managed	desktop	will be several sub-metrics
		4	Accessible Stream Length and Barriers	no	LF	field and/or desktop	plans for culvert condition/location/accessibility study in 2020/2021
		5	Floodplain connectivity	no	acres available for channel migration	desktop	opportunities will primarly be on city-owned property (such as parks) where channels are currently unconfined
Contextual Metrics	measuring to help give context	1	Ambient Air Temperature	yes (by others)	degrees F or C	field	
		2	Precipitation	yes (by others)	inches	field	

Action items

- Send out notes from this workshop #5 – Amy (DONE)
- Schedule workshop #6 – first week in February - Jerry (DONE)
- Develop agenda for Workshop #6 – John and Amy (IN PROGRESS)
- Data Collection and Analysis Plan - Meet to discuss data collection needs and data analyses needs as a result of the selection of the metrics (Jerry, Brian, Christa, Kit) (SCHEDULED; In progress)
- WAR outline – schedule meeting to discuss WAR outline, working off of the City prepared draft - Amy to schedule meeting with John, Christa, Kit, and Jerry (IN PROGRESS)
- BUD – consider preparing a briefing for them – Feb/March timeframe – Brian and Jerry (Wait until closer to that date)
- ESC meeting in April - Brian and Jerry (Wait until closer to that date)

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MEETING SUMMARY

MEETING TITLE	Watershed Management Plan Continued Services - Workshop #6
DATE	2/3/2020
TIME	9am-12noon
LOCATION	1E-110- Bellevue City Hall
ATTENDEES	Brian Landau, Kit Paulsen, Jerry Shuster, Christa Heller, Brianna Pierce, Tanya MacFarlane, Amy Carlson (Jacobs)

Welcome and Workshop Outcomes

- Desired outcomes of this Workshop #6:
  - Shared understanding of current status of Open Stream Condition Assessment (OSCA) and use of data collected
  - Shared understanding of watershed prioritization protocols/approaches used by others
  - Determine city-specific 'management strategy' categories to be used in prioritization
  - Develop preliminary watershed prioritization methodology for Bellevue

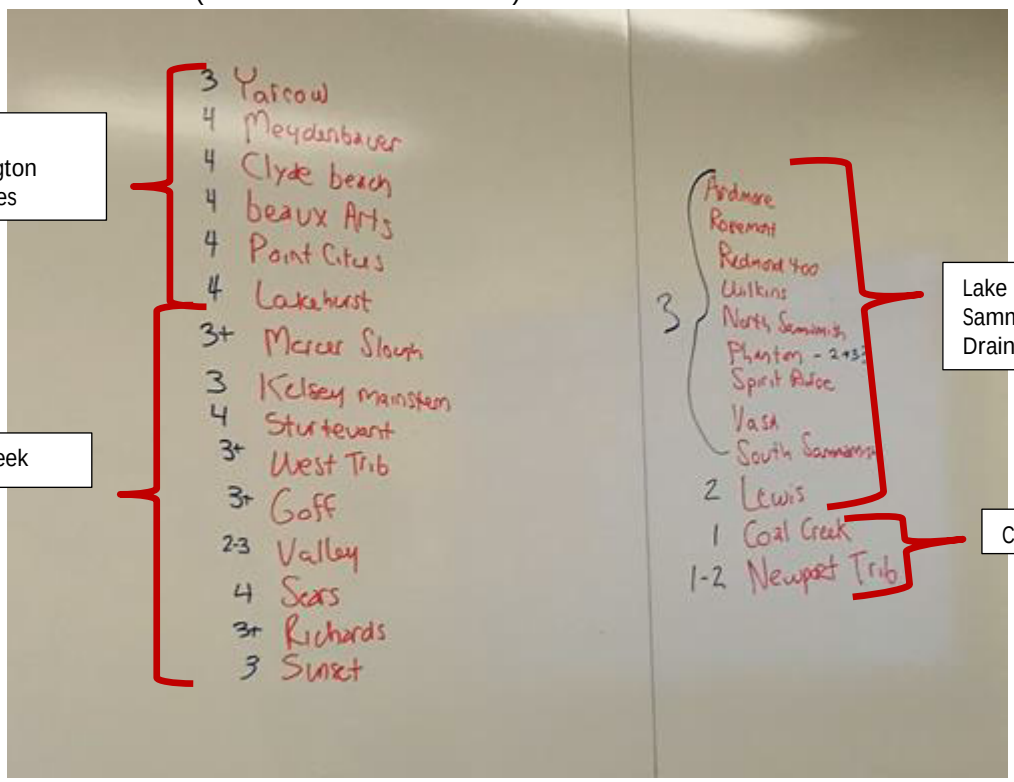
Status of Open Stream Condition Assessment (OSCA)

- Brianna owns the data tool – neat capabilities
- Review of metrics from last workshop – decision to add/modify:
  - Change improvement metric 'riparian canopy' to 'canopy vegetation' and add sub-merics: citywide canopy vegetation and riparian vegetation
- SAM – status, trends, analysis methods that could be used in/by Bellevue, etc. (this discussion tabled until a future date when John Lenth and Don McQuilliams are present)
- How to represent/include Open Stream Condition Assessment in WARs?
  - As Appendix including all data, organized by reach / sub-basin
  - Summarize OSCA information in the main body of the WAR
  - Do we organize according to the metrics we will be using in the WMP (that we just developed), or not?
- First WAR will be Coal Creek – for a 'pilot' WAR:
  - Have data and is processed but not analyzed
  - Haven't decided how to pull in data from tributaries
  - How do we include historical data? (discuss this at WAR outline meeting on 2/21)
- Other use for OSCA Data
  - Baseline for future monitoring
  - Identifing limiting factors
  - Identifying opportunities for restoration

City-specific Watershed Prioritization

- Reviewed other prioritization efforts locally – what did we like? What didn't we like?
- Redmond – reviewed PS characterization then decided to use their own (morphed it a bit)

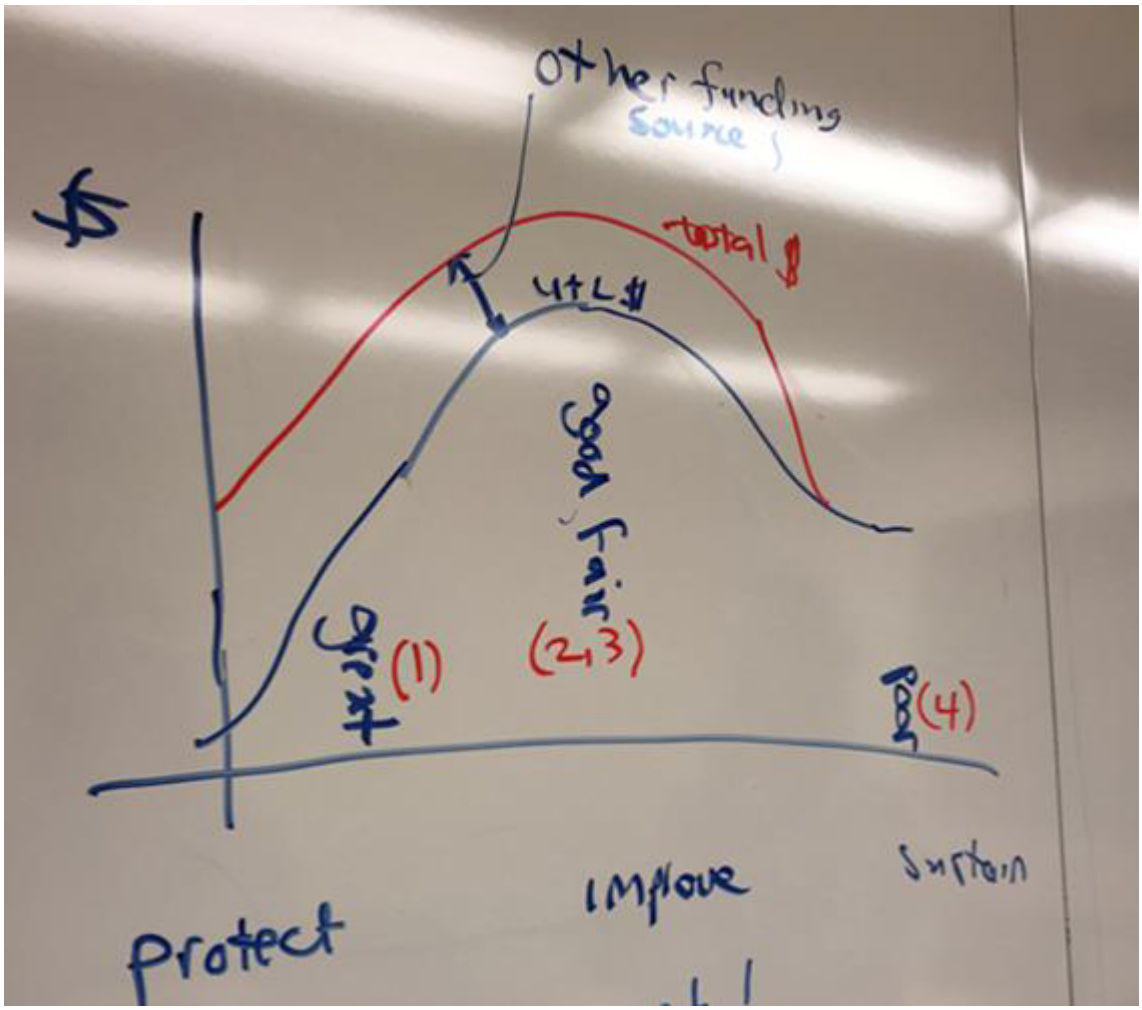
- SMAP – has a process to prioritize that is specified in that requirement, will want to pick a sub-basin that we can move the needle on
- Kit recommends: look at PS characterization but then use it to develop our own
- Developed during the workshop as the COB prioritization process for the WMP planning effort:
    - 3 management strategies (will want to edit these definitions):
        - Protect – invest so as to protect current condition (great/good)
        - Improve – invest so as to improve condition from current status
        - Sustain – invest so as to sustain current condition (as growth/climate change continues to negatively affect stream health)
    - For each sub-basin, assigned one of the following DRAFT condition 'ratings': poor, fair, good, and great, with poor = 4, fair = 3, good = 2, and great = 1 (SEE PHOTO BELOW – note – this is a working draft, subject to change)
    - The poor ratings sub-basins are in the 'sustain' category, the good and fair sub-basins are in the 'improve' category, and the great sub-basins are in the 'protect' category – with the boundaries very fluid
    - Note – boxes drawn around sub-basins to distinguish which sub-basins are in which watershed (and therefore which WAR)



    - Can visualize / represent the magnitude of spending by sub-basin management strategy according to the graphic shown below (x-axis represents the magnitude of spending
        - The most investment in those sub-basins with the 'improve' management strategy (with the greatest opportunity to 'move the needle')
        - Some investment in the poor 'sustain' sub-basins so as to keep them from getting worse

- Some investment in the 'great' – to keep them great
- Note that the red line represents total investment… the blue line represents the City's investment – regional funding sources (ex: salmon recovery) might focus on those 'great' / 'protect' areas, and some on the 'good/fair'/'improve' areas

- Moving forward: No need to force rank sub-basins, priorities will come later with all of our lenses that we place on during WMP development

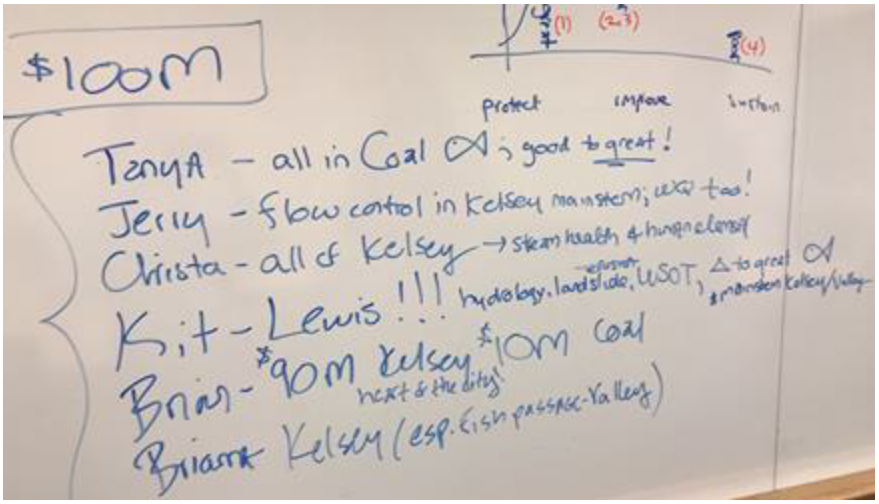


Prioritization Exercise (note – for discussion purposes only)

- City staff participants were asked – if they had $100M, how would they spend it within Bellevue's streams? See photo below
- Themes/observations: each person had a slightly different take on where they would spend the money; lots of energy around Coal and Kelsey!!!!! Not surprising, considering these creeks are in the best condition (and are in that 'improve' and/or 'protect' management strategy)

Utilities

MEETING SUMMARY



Actions

1. WMP outline development (meetings on 2/10 and on 2/21)
2. Management strategies: protect, improve, sustain – need to wordsmith the definitions
3. Coal Creek pilot war – first decide on outline, then get started
4. Develop monitoring plan – for those metrics that require new/additional field measurements – right now, likely: stream temperature, periphyton, benthic macroinvertebrates (stream bugs)
5. SAM status and trends, study of puget lowland ecoregion streams (this was tabled from today's agenda for future discussions with John Lenth and Don McQuilliams present – likely on 2/21/20?)
6. SMAP – need to decide which sub-basin, and develop a process (including a public outreach process, which is required)
7. Longer term actions to be taken after WARs are developed, during WIP development (too early in our process to do these now):
    - Develop annual reporting structure/template – is this different than CIP reporting (ex: LF of stream habitat improvements, number of pieces of wood added, etc.)
    - Coordinate with Environmental Services Initiative (with/at Environmental Services Commission) – for example, water quality – their definition (fishable swimmable?) vs. ours
    - Communications out to public/leadership: be clear what this WMP does and doesn't do (won't fix beach closures)

Appendix B – Details of Stream Condition Metrics, Management Improvement Metrics, and Contextual Climate Metrics

Jacobs

DRAFT Memorandum

Foundational Element Memorandum #2 - Metrics for Assessing Stream Health Improvements

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Stream Condition Metrics, Management Improvement Metrics, and Contextual Climate Metrics for Use in the City of Bellevue's Watershed Management Plan (WMP)

Type	How Used		Metric	currently collected?	Units	How collected?	Notes
Stream Condition Metrics	measuring outcomes, benefits - to stream health	1	stream flow	yes	cfs, depth	field measurement	rating curves are good; should review historical data for pulse counts; might need to add monitoring gages
		2	substrate composition	yes	visual characterization	field measurement	part of open stream condition assessment
		3	stream pools	yes	visual characterization	field measurement	part of open stream condition assessment
		4	stream wood	yes	counts, size, location (buckets by class)	field measurement	part of open stream condition assessment
		5	riparian canopy vegetation	yes (in City GIS)	acres or square feet	desktop	TBD how - possibly take citywide tree canopy GIS information and 'clip' for within 100' of stream channel
		6	stream temperature	no	degrees F or C	field measurement	tidbits or else stream probe
		7	periphyton	no	plate density, counts	field measurement	appropriate to do at same time and locations and frequency as BIBI; do have 1 sample of diatoms (per Kit - use Puget Sound Lowland Index)
		8	benthic macroinvertebrates (stream bugs)	yes	BIBI index, sub-metrics within the BIBI index (TBD)	field measurement	no need to expand current sampling plan (per Kit: Some of the bug metrics are not within the BIBI index, but rather species specific tolerances)
		9	resident fish	yes	abundance,	field measurement	no need to expand current sampling plan (per Kit: resident fish should include size classes - there may ber a shift to smaller fish but there may be lots of them)
		10	salmon presence	yes	spawning surveys, presence of adults?	field measurement	no need to expand current sampling plan
Management Improvement Metrics	measuring the individual actions we are taking to get the outcomes we want	1	riparian canopy vegetation	yes (in City GIS)	acres or square feet	desktop	will be sub-metrics: citywide canopy vegetation and riparian canopy vegetation; TBD on how to utilize existing City GIS information
		2	Impervious Surface	yes (in City GIS)	acres or %	desktop	TBD on total impervious surface, effective, PGIS, and/or treated PGIS; use City's existing information (in GIS)
		3	Structural Stormwater Controls	yes	number, type, acres/inches managed	desktop	will be several sub-metrics; may need to use GIS and other information to develop data sets
		4	Accessible Stream Length and Barriers	no	LF	field and/or desktop	plans for culvert condition/location/accessibility study in 2020/2021
		5	Floodplain connectivity	yes (in City GIS)	acres available for channel migration	desktop	opportunities will primarly be on city-owned property (such as parks) where channels are currently unconfined
Contextual Climate Metrics	measuring to provide context	1	Ambient Air Temperature	yes (by others)	degrees F or C	field	obtain data from others
		2	Precipitation	yes (by others)	inches	field	obtain data from others